COLONY AND PROTECTORATE OF KENYA

DEPARTMENT OF AGRICULTURE
ANNUAL REPORT
1961

VOLUME I

REPORT OF THE DIRECTOR OF AGRICULTURE

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REPORT OF THE DIRECTOR OF AGRICULTURE

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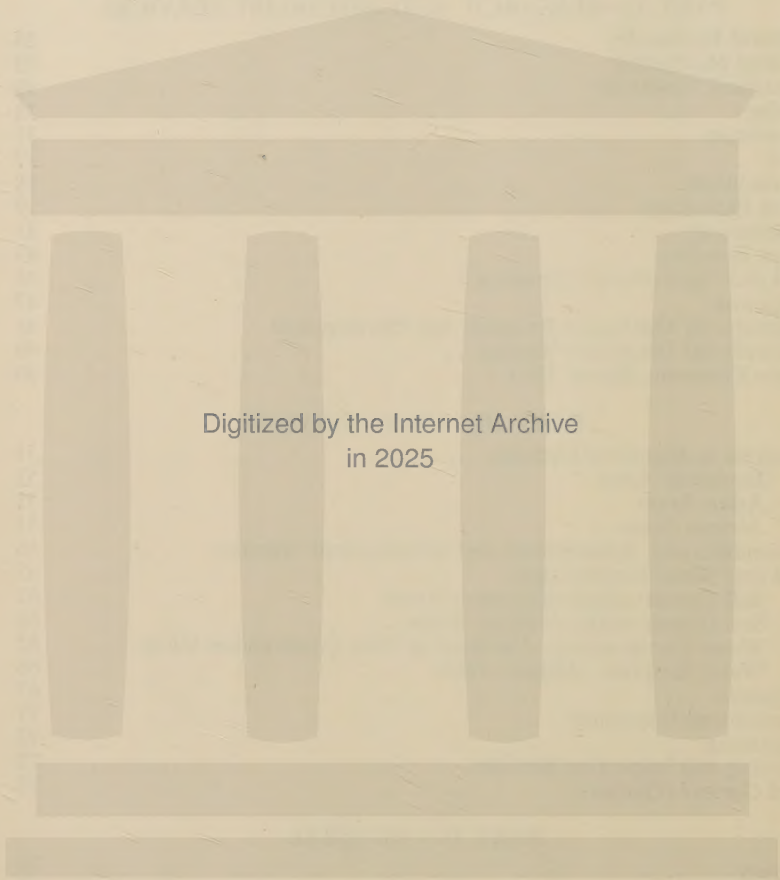

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DEPARTMENT OF AGRICULTURE ANNUAL REPORT, 1961
VOLUME I

PART I.—AGRICULTURE IN 1961

Review of the Year

Nineteen-sixty-one was a year that the great majority of Kenya farmers are unlikely to forget, for one disaster followed another and led to famine and flood, loss of crops, grass and stock. The first three-quarters of the year saw severe drought conditions over wide areas of the country. Army Worm caused great damage from the onset of the long rains which failed in many areas and although control measures were successfully applied in many areas, the cost to the country in crops, grass (and consequently animal products) and in control measures was heavy. Failure of the long rains accentuated the famine situation and this grew progressively more serious as the year wore on and shortage of food in Machakos District, Masailand, Turkana, Baringo and parts of Central and Coast Provinces became acute and necessitated the initiation of famine relief on a national scale. Exceptionally heavy rain in Tana River District combined with equinoctial tides brought severe flooding to the part of the Coast Province lying within the triangle Lamu-Galole-Malindi. The onset of the short rains up-country brought unprecedented flood conditions to many parts of the country, with damage to crops and disruption of road and rail communications which added to the difficulties of distributing famine relief in many areas.

When the flood waters reached the lower Tana and Sabaki Rivers the destruction of villages and crops was almost complete; Royal Air Force aircraft, Royal Navy helicopters and amphibious craft were used in rescue and food distribution operations. The Department was heavily committed in the Coast Province in surveying the damage and making plans for rehabilitation measures and considerable sums of money were made available from the National Famine Relief Fund to facilitate the supply of seed and planting material as the floods receded. One of the worst features of the flooding was the almost complete destruction of the banana groves (mainly plantains) which are a very important stand-by food crop of the Pokomo people in times of food scarcity.

Up-country, immense damage was wrought on food crops, especially wheat, barley and beans. The principal cash crops, coffee, tea and sisal were relatively unaffected and the production of grass has, of course, been something on the credit side. Pyrethrum yields have suffered to some extent as a result of attacks of bud disease and weed competition. In Masailand heavy losses of stock occurred. The intense rain caused considerable damage to dams and severely tested soil conservation works. A notable feature was the very satisfactory control of erosion by bench terraces and grass strips. Narrow based terraces, on the other hand, failed in many places largely because they had not been properly maintained by the people.

In African districts there has been a serious deterioration of control on grazing schemes and in standards of cultivation and processing of coffee in some areas. In more progressive districts development work on African farms has forged ahead and there has been some active co-operation and indeed enthusiasm on the part of the people themselves for the work of the Department. On consolidated and planned farms the contour layout covers soil conservation requirements and these farms give no cause for concern on this score. Elsewhere, through neglect of soil conservation measures, there is a grave risk of the land reverting

to its original state and the initiation of enclosure or consolidation and planned farming may be too late to prevent this. Much greater efforts must therefore be made to bring home the seriousness of the situation and to secure the co-operation of the people.

The situation on European farms and plantations has continued to suffer from lack of confidence and stability and the position has not been improved by irresponsible statements on the land question by some politicians. At a time when the Kenya economy is exceedingly shaky it is tragic that this situation should drag on indefinitely, especially when there is every evidence of a very real desire for the fullest co-operation between farmers of all races and when the Department has, as a result of years of experience and research, the knowledge to take the country forward to a prosperous future. A very noteworthy feature of the year has been the continuation and rapid speeding up of the process of broadening the basis of representation on statutory boards and other bodies connected with the organization of the agricultural industry to include African farmer representatives. These African farmers are doing a fine job and have demonstrated a sound and constructive approach to the problems confronting these various bodies which has been very cheering. At Provincial and District level, the work of Divisional, District and Provincial Agricultural Committees has made excellent progress enhancing the importance of bringing in the farmers themselves on questions of policy making, a process which makes it possible to begin to obtain the support of the farmers themselves in carrying out unpopular measures, e.g. soil conservation work and the implementation of cash crop rules which are, of course, necessary for the well-being of the people. This immediately improves the relationship between the extension officer and the farmer, which should and can be on a friendly and helpful basis and has been exceedingly difficult to attain when the extension officer has had the sole responsibility for putting across measures which are unpopular with the people, because the reasons for these have frequently been misunderstood and have tended to become political issues.

During the year the Department has been heavily committed in assisting the Land Development and Settlement Board with technical advice for its settlement schemes on land under examination for purchase from European farmers. There is always the risk of conflict between the technical agriculturist on the one hand and the administrator and politician on the other when subdivision schemes are being considered, because the agriculturist makes his recommendations on the basis of what the land can be made to produce, while the administrator may be under severe pressure to settle the maximum number of people on the land. The agriculturist, while recognizing the need for some concessions to political pressure, can be expected to recommend procedures which satisfy the best principles of land use and the long-term profitability to the farmer himself and to the economy of the country. The dangers of making decisions purely on the grounds of political expediency must be avoided and it is imperative that political and technical considerations be welded so as to meet both the short-term and long-term needs of the African farmer.

Among the outstanding successes, mention must be made of the Mwea/Tebere Irrigation Scheme in Embu District, where 1,245 tenants and their families are engaged in growing rice on 5,000 acres of black cotton soil. In 1961 the average tenant on the scheme earned a net income of Sh. 2,854 after paying for all services provided by the Scheme. Some of the more outstanding tenant-farmers earned net incomes of up to Sh. 5,000. Average incomes and yields such as those obtained at the Mwea Scheme place these farmers amongst the wealthiest rice producers in the world. The Shimba Hills Settlement Scheme in Coast Province has also shown very encouraging progress though shortage of funds

may prevent the Department from taking the fullest advantage of the situation. At Galole on the Tana River, the pilot settlement scheme continues to point clearly to the favourable possibilities for a major irrigation settlement in the Lower Tana area if the necessary finance can be found to proceed with it. Working parties set up by the Ministry of Agriculture are currently examining the possibilities of greater participation by African farmers in the sugar and sisal industries.

It is very satisfactory to be able to report that African farmers are showing clear signs of increased interest in the use of fertilizers, not only on coffee, but on other crops. The Department is encouraging the use of fertilizers through the Farmers' Training Centres. This is a matter of the utmost importance because in many parts of the country the phosphate deficit in the soil is one of the main brakes on increased production.

More Africans are showing interest in agriculture as a career and indeed increased interest in agricultural education at all levels is a very encouraging feature of the present time from the farmer level upwards. The Department's efforts to increase the degree of localization of the Service has made very good progress at the Assistant Agricultural Officer level. Special courses arranged locally have enabled the Department to up-grade the best material in the Agricultural Instructor cadre, while the throughput of Diploma level students at the Egerton and Siriba Agricultural Colleges has been stepped up. The position is thus reasonably satisfactory at this level of training. At the professional level ("A" Scale), while every effort is being made to bring forward suitable local candidates, it is obvious that there will be a serious shortage of staff if too many expatriate officers decide to leave when Independence comes. The Department is receiving very considerable help from the Agency for International Development (U.S.A.) in connexion with training courses for personnel under consideration for localization up-grading.

An important event towards the end of the year was the visit of a World Bank Mission to examine and report on the agricultural development programme. The report of this Mission is expected about the middle of 1962.

From the Research Division of the Department, information of the utmost value to the industry steadily becomes available. The Plant Breeders are producing new material of great promise. The new maize known as Kitale Synthetic II is a considerable advance on anything previously available and is intended for areas where high potential maize growing is possible. The short-term varieties, such as Taboran, have begun to make a contribution to agriculture in the short rainy season districts where famine is an ever-present threat. These areas too are likely to benefit greatly from more recent work on beans, cowpeas, sorghum and millet. In the field of wheat breeding it is very gratifying to see more Kenya-bred wheats among the varieties coming up for release to farmers. Good progress is being made in acquiring knowledge of plant/soil/water relationships. The work of the Coffee Berry Disease Unit will be completed early in 1962 and the advances in our knowledge of the epidemiology and control of Coffee Berry Disease and Leaf Rust have been of the utmost value. At the Grassland Research Station at Kitale advances in our understanding of herbage/animal nutrition relationships are of the greatest importance not only to our own animal industries, but to those in many other parts of the world.

Land Management

Nineteen-sixty-one showed a further sharp reduction in the number of farms planned in the Scheduled Areas and 18 farms totalling 19,925 acres, were planned compared with 46 farms totalling 66,736 acres in 1960. However, survey for resettlement schemes occupied the survey teams all over the Scheduled Areas.

Among the European farmers, political uncertainty and the adverse climatic conditions seriously affected development and a sharp rise in the number of Europeans leaving the Colony was noted.

In the Non-scheduled Areas considerable progress has again been made in 1961. Land consolidation, skeletal planning and farm layout have featured in the progress made in Central Province. Nyeri and Kiambu Districts are fully consolidated; Meru is going ahead slowly; Embu is expected to be completed in early 1962. Fort Hall, as a result of considerable agitation on the part of the local people necessitated the reopening of land registers and the whole district had to be dealt with again. Considerable progress had been made by the end of 1961 and the reassessment has resulted in more consolidation, better farming and a more contented people.

In the Coast Province some slow but steady progress has been made in Kwale. Twenty-four farms were planned which has encouraged other farmers to consider this service. Kilifi District, badly hit by drought, has only 13 of its 25 planned farms functioning properly.

In Southern Province in the Masai districts of Kajiado and Narok, the demand for enclosure and individual demarcation continues to grow.

In the Rift Valley Province 266 farms were laid out and planned during the year in the West Suk, Baringo and Elgeyo/Marakwet Districts.

In Nyanza Province progress has been made in some areas mainly in North Nyanza in the Lurambi, Marame and Kisa locations. Progress is also reported from Kericho (Kipsigis) and Kisii.

Grass leys and improved stock continue to play an increasing part in sound rotational farming. The use of leys such as Rhodes and Star Grass are obviously necessary where exotic cattle and sheep are introduced. Exotic cattle are popular and continue to thrive under improved conditions.

Staff shortages held up layouts and skeletal planning. Demands for extension work in the form of requests for layout are far in excess of the staff able to cope with these requests. Progressive districts have had to go ahead with such staff as were available. There has been a grave decline in the standards of some aspects of land management in African areas during the course of the last year. The three main aspects of this decline are:—

the collapse of the majority of the grazing schemes which had been developed by considerable effort and expenditure in semi-arid areas;

the general breakdown of soil conservation measures in many African districts;

the deterioration in standard of coffee culture.

Many of the grazing schemes have broken down through failure to pay fees and refusal to accept the necessary measures of rotational control which are involved therein. Without the payment of fees these schemes cannot be self-supporting and as a result water supplies cannot be maintained. Water supplies have been deliberately destroyed in some grazing schemes, notably in the Yatta. Only two or three years ago we prided ourselves on the fact that we had a very large area of hitherto eroded land under grazing control. This is no longer the

case. There are no successful grazing schemes at the present moment other than in the West Pokot (Suk) and Baringo.

Deterioration of soil conservation has been equally disastrous and just as important. It has particularly affected certain districts such as Machakos. In that district apparently none of the narrow base terraces which have been dug in the past are now maintained and as a result of this and of drought, there has been a falling off in the amount of food produced by subsistence agriculture, increasing the necessity for famine relief. Similarly, in many Central Province districts, which were formerly well terraced, there is now very little to be seen of the work that was put in over the past decade. It could be truthfully said that only in those areas where bench terraces or grass strips were an effective method of soil conservation have soil conservation measures been maintained.

Thirdly, there is a decline in the standard of coffee cultivation. Five years ago it would have been rare to see a coffee plantation in African areas inadequately mulched. Now, the properly mulched plot is the exception rather than the rule.

In some areas such as Meru, where formerly coffee cultivation was of a very high standard, not only have the majority of plots not been mulched, but serious erosion has taken place in the last heavy rains, exposing the roots of the coffee bushes and undoubtedly seriously affecting the yield and quality of the coffee. There has also been a falling off in quality standards at coffee factories and in some districts where formerly one expected to have more than 50 per cent of the crop in the first three classes, the percentage is now nearer 30 per cent to 40 per cent. All this has resulted and will continue to result in heavy loss to the producer in terms of actual cash received for his coffee, both by reduced yield and by reduced quality of the coffee prepared in the factory.

On the credit side we can find a steady development of planned farming and farm layouts on the better land in Central Province by more progressive agriculturists. In some parts of Kiambu District for instance, it is now very evident that great progress is being and has been made in terms of better agriculture. The total number of farm plans and layouts, however, does not represent more than 3 per cent to 4 per cent of the total potential number of farming families and since only about 50 per cent of the farm layouts are effective, this figure should really be more like 2 per cent to 3 per cent. Even allowing for the efforts of other people such as the Nandi and the Kipsigis, who have voluntarily enclosed their land and have done a good deal to develop it without special assistance from the Department, it is safe to say that certainly no more than 10 per cent of the African land is soundly farmed at the present time.

Mixed Farming Livestock Enterprises

The area under grass leys in the Scheduled Areas has again increased from 220,100 acres in 1960 to 230,500 in 1961. Both figures may include a proportion of reverted pasture. There are, in addition approximately 2,000,000 acres of natural grassland in the ranching districts of the Scheduled Areas. At the end of the year grass was plentiful following the heavy rains in the latter half of the year, but drought and Army Worm had seriously depleted grazing in the early part of the year. Departmental advice for some years has been for farmers to have at least one year's silage in reserve. Never has this advice been more sound than in 1961. However, high cost of fodder programmes, brought to light by the Farm Economic Survey have shown how the growing of fodder crops and silage-making can reduce profits, so that means of reducing the cost of this branch of sound farming are being sought. Shortage of grass is reflected in a

reduced number of dairy animals and the production of both whole milk and butterfat during 1961.

	Dairy Cows	Total Dairy Animals	Whole Milk (gals. 1,000)	Butterfat (lb. 1,000)
1958	143,000	411,000	17,147	11,066
1959	152,000	427,900	18,375	11,565
1960	148,800	412,900	18,958	11,444
1961	145,500	385,400	17,918	10,787

The average price of butterfat for the year was Sh. 2/71 per pound and for whole milk Sh. 2/15 per gallon. The relative profitability of beef cattle compared with the dairying enterprise has caused some dairy farmers to turn partly to beef farming on both mixed and dairy ranching holdings. The number of beef cattle sold to the Kenya Meat Commission for slaughtering in 1961 rose to 165,300 head, of which 107,400 came from European farms and ranches. Heavy slaughtering and deaths due to drought reduced the numbers of beef cattle in the Scheduled Areas. The price paid for first grade beef was Sh. 1/30 per pound and Standard "A" Sh. 1/20 per pound.

	Beef Cattle (Scheduled Areas)	
	Cows	Total
1957	116,000	484,000
1958	121,000	506,000
1959	128,000	532,000
1960	134,700	567,300
1961	129,300	549,200

The price paid by the Kenya Meat Commission for "A" grade mutton was Sh. 1/60 per pound and for Highland lamb Sh. 2/50 per pound. The average price of wool was Sh. 2/59 per lb. The wool industry has increased in importance during recent years and the figures for woolled sheep in the Scheduled Areas show a steady increase in numbers, reflected in the increased importance of wool as one of Kenya's exports. A production of 2,246,000 lb. in 1960 rose to 2,672,500 lb. in 1961.

	Sheep (Scheduled Areas)	
	Woolled Sheep	Total
1957	305,000	445,000
1958	353,000	488,000
1959	412,000	549,000
1960	457,200	582,000
1961	491,700	587,800

The pig industry continued its decline and from a population of 70,200 in 1958 and 50,600 in 1960, the number of pigs in the Scheduled Areas has fallen to 41,400. This can be attributed to the political situation and the fear of feed shortages. The latter factor has been accentuated by the appalling harvest. The price of pigs and their profitability would appear to have but little influence on the situation and prices appear to give a very reasonable margin of profit to the producer. The average price paid by Uplands Bacon Factory for all grades was Sh. 198 per pig.

The Farm Economic Survey Unit based on Njoro continued its economic survey in four areas, i.e. Njoro, Trans Nzoia, Uasin Gishu and Molo/Mau Narok and the collection and analysis of data was continued on 68 farms. Four reports were published in 1961, giving a total of eight reports since the survey began in 1958. In addition small pilot surveys were undertaken in the Nandi and Elgeyo/Marakwet Districts to inquire into peasant farm units. A full analysis of accounts kept on the Rift Valley experimental farms has become a regular addition to the work of the Unit. In September an economic survey of South Nyeri District was initiated.

Plantation and Cash Crop Industries

The estimate for the 1961/62 coffee crop is 32,487 tons. European plantation coffee accounts for slightly more than two-thirds of the crop. However, production from African areas has again risen steeply and comparative figures are interesting. The decrease in the European tonnage can be attributed to the dry conditions, while the increase in the African tonnage is the result of new plantings coming into bearing and in part, the better rainfall received in African coffee districts.

1960/61		1961/62 (Estimate)	
	tons		*tons*
European	24,960	European ..	22,143
African	7,260	African	10,344

Drought during the early part of the year was followed by exceptionally heavy rains. Both adversely affected quality and the rain in the latter half of the year hampered drying of the early crop. The excessive rain caused a rapid spread of Coffee Berry Disease and it was in general a bad year for both pests and diseases.

During the year a Working Party on sisal was set up to consider ways in which African farmers in certain parts of the country might be encouraged to become sisal producers. Poor quality hand decorticated fibre from hedgerow leaf in African areas was a serious problem in 1961 and was the cause of large claims against the owners of factories handling such fibre. The Kenya Sisal Board and the Department of Agriculture were extremely perturbed, as there is a grave risk that it may affect the reputation of Kenya sisal on overseas markets and active steps have been taken to rectify the position.

The 1961/62 cotton crop suffered seriously from the excessive rain in the latter part of the year and only one-third of the estimated crop is likely to be harvested.

Drought during the first half of the year would appear to be responsible for the drop in production of tea in the Colony of some 2,000,000 lb. In addition, a substantial fall of prices on the London market gave lower returns for the reduced crop.

A further increase in the production of pyrethrum took place. Over-production on quotas by the African areas was again noticeable this year. The extremes of weather adversely affected the crop. The Pyrethrum Board is very actively seeking new markets for the increased production, but at the end of the year slow movement of stocks in the market indicated that it would be necessary to reduce quotas to growers, at least for a period.

Sugar production rose by 10 per cent during the year, total production amounting to over 32,000 tons. A new development in the sugar industry was the introduction into Kenya of the first sugar refinery by Miwani Sugar Mills.

Of the other cash crops of local importance a slight increase in the tonnage of pineapples delivered to the canneries and the Nairobi market was reported. Loans totalling £7,500 were made available to African farmers for the purchase of fertilizers for pineapple production. Wattle production declined, but in spite of competition in world markets from such products as Quebracho, wattle is still an important factor in farmers' incomes in parts of the Colony such as Uasin Gishu and Central Province. Other cash crops and farming enterprises are replacing wattle in many areas. Increased production of cashew nuts in the Coast Province resulted in increased returns to growers from £192,998 in 1960 to £252,000 in 1961. Heavy and abnormal rains affected the quality of the 1962 crop severely. A Working Party was set up at the end of the year to study the many marketing problems connected with this crop. The acreage of coconuts increased slightly as also did production of copra and fresh coconuts.

Cereal crops were also very badly hit by the heavy rains, especially at harvest time. Excellent standing crops were ruined by the untimely and persistent heavy rains and a mere 752,364 bags (200 lb.) should be harvested from 221,642 acres of wheat planted. Of this yield it is estimated that 30 per cent to 40 per cent will be sprouted or germinated and so unsuitable for milling. The maize crop suffered badly from the 1961 attack of Army Worm and 100,000 acres were estimated as attacked in Rift Valley Province alone, although most of this was saved by spraying. Barley was also severely damaged by the rain at harvest time, causing lodging of the crop and late weed growth.

Agricultural Education

Agricultural education was a major and vital feature of the Department's extension work during 1961. The Farmers' Training Centres once more proved popular and successful and concrete results could be seen in the field where follow-up extension work proved possible. Altogether 7,263 farmers, their wives and junior Government staff attended the 13 Farmers' Training Centres in 1961.

Both Egerton College, Njoro, and Siriba College, Maseno, were engaged in agricultural diploma courses while the Provincial Agricultural Training School at Embu continued to educate to the certificate in agriculture level. Kaimosi Training Centre in Rift Valley Province also provided certificate training as well as farmers' courses.

Post-graduate studies in the U.S.A. under A.I.D. for four African Assistant Agricultural Officers resulted in their promotion to the "A" scale as Agricultural Officers on their return to Kenya.

Following a course on extension and administration at the Kenya Institute of Administration, 11 Agricultural Instructors were promoted Assistant Agricultural Officers on the "C" scale and one Agricultural Instructor was promoted to Assistant Agricultural Officer following a successful course in Israel.

Irrigation

Of the three irrigation schemes run by the Agricultural Department only that at Mwea can be said to be thoroughly successful. In the Mwea Scheme 5,000 acres were under irrigation by 1,246 tenants, producing an average yield of 30.25 bags of paddy and an average income of Sh. 2,854 per annum, after paying all their dues. Ninety-two tenants had yields of more than 40 bags of paddy each and the highest income to an individual was £274 after paying all dues. This settlement represents the largest single block of prosperous African farmers in the whole of Kenya without any exception.

The scheme at Galole cannot conceivably be economic on the present basis and it is in fact only to be regarded as a pilot scheme to test the development potential of the area. In 1961 it was reviewed and the decision was made to continue on a year-to-year basis, with an annual review. It was also decided to admit Pokomo tenants, who have done well there. It is intended in 1962 to increase the scheme to 1,200 acres and preparations for this are in hand. This should result in less loss of money to Government and should increase the prosperity of the area generally. Unfortunately, during 1961 very heavy losses to the cotton crop were suffered from excessive rain and very severe floods. The yield, which was anticipated to be 1,200 to 1,400 lb. of seed cotton, was reduced to about 900 lb. of seed cotton per acre.

The third irrigation scheme at Perkerra continues to labour under very serious difficulties. During 1961 the river first practically dried up, making any form of irrigation almost impossible, and then came down in violent floods, which not only carried away part of the head works, but also overflowed and damaged a good many of the holdings on the scheme. As if that were not enough, the onion crop on which all hope was centred for a successful scheme, was stricken by a fungus disease, *Botrytis* blast, which has never seriously affected onion crops in Kenya before, but which ruined the Perkerra crop. Despite these difficulties the tenants at Perkerra are working hard and are in good heart and co-operating with the management. Nut grass continues to be a problem in the scheme and additional difficulties have been caused by heavy deposits of silt in the irrigation canals brought down by the floods. The Perkerra scheme cannot possibly be economic on its present acreage and there seems no real justification for extending it at the present time. The main hope for the future in the Perkerra scheme seems to lie in the more effective use of grazing as opposed to arable cropping.

Other small irrigation schemes are operated in various parts of the country at Taveta, Kiai, Endo, Wei Wei, Kano Plains, etc. These schemes do not come under the aegis of the Joint Irrigation Committee and are largely financed by ALDEV in the first instance. Some of them are operating reasonably efficiently, such as those at Taveta, while others are not. There has been a big decrease in the irrigated acreage on the Kano Plains in the last year, largely because of the lack of communal labour to clean rice irrigation channels.

Research

Research activities continued at much the same level as in previous years. Support from various plantation industries contributed much of this satisfactory result, as did generous aid from Colonial Development and Welfare funds, the United States A.I.D. and the Rockefeller Foundation.

An important part of the work of the Research Division in 1961 has been to impart results to all concerned in the production side of the agricultural industry. All means have been employed with some encouraging results. One of the effective means of getting research and grower liaison has been the continued functioning of the numerous Research Advisory Committees. A new committee for research on the potato crop was constituted during the year. Special mention must be made of the Animal Husbandry Resarch Co-ordinating Committee, the work of which has enabled the programmes of the Veterinary and Agricultural Departments to be brought together.

A new development was the creation of an intelligence section. This unit comprises the statistician and his staff, an officer responsible for the introduction and follow-up of new plant material and an agricultural officer who is responsible for the central records of research work, the provision of technical information derived from these records and assistance in liaison on projects carried out by the field research officers. The unit is housed at the Scott Agricultural Laboratories.

Amongst the numerous research projects mention can be made here of a few of the year's most interesting features. Dr. John P. Hollis, Fulbright scholar, has initiated a programme of research with soil fumigants for the control of nematodes on pineapples, sisal, tea, coffee, beans and pyrethrum. Nematode surveys are also being undertaken by him. The work of the Coffee Berry Disease Unit, covering not only coffee berry disease, but coffee rust was nearing completion at the end of the year with satisfactory control worked out for both diseases. A plant breeder joined the staff of the Pyrethrum section towards the end of the year to permit intensification of work on this aspect of pyrethrum research.

Continued trials with various *Dioscorea* spp. for diosgenin production indicated that the prospect of introducing this as a new crop, albeit a minor one, remains bright. Conclusion of a series of soya bean trials has demonstrated that economic yields from this crop can be obtained in the western part of Rift Valley Province. The year was an interesting, as well as a difficult one for the plant breeders working on cereal crops. It saw the release for general planting in 1962 of the Kitale Synthetic II maize, 3,000 acres of which were grown in the the past year; in addition the short-term variety, Taboran, became available commercially in October, and an encouraging number of small 5-lb. packets of seed has been sold to African farmers in the dry areas. Further evidence on the ability of fast maturing crops to conserve soil moisture came forward during the year from Katumani Experimental Farm. This confirmed the value of selection for earliness in maize and other crops in the dry areas with two short rainfall seasons per year. Encouraging progress was made in the selection of suitable high yielding short-term cow peas for these areas.

Some outstanding work has emanated from the Pasture Research Chemist's laboratory at Kitale, which has attracted world-wide attention from animal nutrition workers. The Senior Soil Chemist has reviewed the whole field of crop nutrition and issued a valuable guide to fertilizer use in Kenya, for the printing of which we are indebted to local fertilizer interests. Some useful work has been undertaken by the Agriculutral Engineer based at Nakuru, including the development of a small prototype decorticator for Doum Palm fibre extraction. Visiting experts from Australia have been particularly impressed with the field of subterranean clover which has been successfully established at the Marindas Grassland Station in the Highlands.

The Rainfall of Kenya, 1961

Nineteen-sixty-one will go on record as a year of extremes in tropical weather. The sparse rains of April/May did little or nothing to alleviate the 12-month-old drought over the extensive plains of Central, Southern and Coast Provinces, many areas becoming completely arid. The first signs of a complete reversal in the weather pattern became evident in September, when 48 hours of extremely intense rainfall produced extensive flooding in the lower Tana and Galana River basins. Rainfall became general early in October over northern and central districts of Kenya and spread southwards to the Tanganyika border by the end of the month; from then until the end of the year rain of unprecedented persistence and intensity was experienced in all areas, daily falls of three to five inches became almost commonplace and monthly totals were far greater than any previously recorded—in some cases for more than 60 years.

Reviewing the year in more detail; the first three months were generally warm and dry, although a few showers developed from time to time over the Highlands and in Nyanza Province. Fairly widespread rain started in most areas about 5th April, but soon became intermittent and April totals south of the Equator were only about 50 per cent of average; the only exception was the coastal area north of Malindi which received its normal April rainfall.

During May, Nyanza Province, north-western areas of Rift Valley Province and northern areas of Northern Province recorded average falls, but most other areas were unseasonably dry. June brought some rain to Turkana and Samburu Districts, near-average totals in northern areas of Nyanza and Rift Valley Provinces and along the coast, but very dry conditions again over the plains and the low-lying areas of the Rift Valley and Nyanza.

July brought exceptionally heavy rain along the coast and also in north-western districts, but totals were well below average in areas east of the Mau Escarpment, and dry conditions persisted over the plains. Heavy rain continued over Western Kenya during August and occasionally extended eastwards over the Aberdares to the Mount Kenya area; the drought continued over the plains, and seasonal scattered showers occurred along the coast. The main feature in September was the extremely intense rain recorded in the Coast Province north of Mombasa; several places measured between 15 and 20 in. in less than 48 hours; inland, conditions were somewhat cloudier and cooler than is normal for September, rainfall was generally slightly above average, although deficiencies were noted in the south-west.

As mentioned above, the last three months of 1961 produced unprecedented rain in all parts of Kenya. In October the area of heaviest rain comprised the eastern slopes of Mount Kenya and the Aberdares, with several totals of over 50 in. being recorded in the Meru District. During November heavy and persistent rain extended to all parts of Kenya, and previous highest November totals were exceeded in all areas except the Coast Province. Kiambu recorded over 30 in., many parts of Central Province, Nairobi area, and Kericho and Kisii Districts had over 20 in. Wajir's total of 24 in. was an all-time record—the *annual* average here is less than 10 in. In December, the rain became more scattered and long sunny spells occurred in northern areas and on the coast; however, some very heavy storms caused further flooding at times in Southern and Nyanza Provinces, southern districts of Central Province and in the Nairobi area.

TABLE A.—RAINFALL FIGURES

Name of Station		Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Coast Province—														
Kwale, D.C.	Total	0·34	1·84	1·02	3·93	1·62	2·58	7·75	3·25	12·35	9·31	10·36	3·12	57·47
	%	27	239	44	63	18	69	241	137	454	260	276	98	136
Voi, Wundanyi Estate	Total	1·18	1·05	1·85	8·02	2·92	0·53	3·11	0·35	4·71	9·27	17·26	5·48	55·73
	%	58	58	32	75	52	33	241	18	198	233	207	79	106
Mtwapa, Tree Crop Station ..	Total	0·00	1·44	1·05	7·01	1·03	3·26	11·81	3·21	12·27	9·49	9·73	4·48	64·78
	%	0	169	91	53	14	60	157	118	281	230	290	181	122
Lamu Meteorological Station ..	Total	0·00	1·21	0·57	4·93	3·81	5·79	10·01	2·07	19·18	2·08	8·46	1·13	59·24
	%	0	1,344	76	97	28	95	393	134	1,697	143	742	103	170
Malindi District Office	Total	0·00	1·16	0·09	7·60	4·08	5·50	16·38	2·47	20·29	8·70	9·38	3·96	79·61
	%	0	552	7	126	30	84	471	115	1,103	364	521	374	195
Galole, Tana Irrigation Station ..	Total	2·94	1·85	0·24	2·32	0·09	0·16	2·35	0·73	11·96	3·51	8·72	2·63	37·50
	%	275	231	20	98	7	23	214	170	396	179	230	147	192
Nyanza Province—														
Kakamega District Office	Total	0·00	1·59	8·19	8·79	7·28	4·37	4·39	15·58	17·13	11·05	18·80	10·68	107·85
	%	0	45	141	90	70	58	63	170	242	233	499	302	146
Sotik, Craigmore	Total	0·51	6·05	6·63	6·25	3·35	2·55	0·32	5·60	6·05	6·76	12·88	10·36	67·31
	%	15	166	107	85	56	49	10	102	137	217	354	250	121
Bungoma, Agriculture	Total	0·37	2·40	5·45	8·69	9·15	7·18	4·63	6·84	14·37	8·71	10·08	3·73	81·60
	%	17	122	100	88	100	130	104	123	270	142	224	117	129
Kibos Cotton Station	Total	0·22	3·49	5·97	8·20	6·56	1·34	1·06	3·82	6·16	5·10	18·28	10·89	71·09
	%	10	120	98	97	117	46	41	116	179	193	372	286	145
Maseno Agriculture Department ..	Total	1·21	3·22	7·23	9·76	10·23	4·79	3·59	6·86	6·66	15·27	15·14	14·42	98·38
	%	44	94	113	93	114	87	100	112	115	296	299	290	144
Homa Bay Ginnery	Total	0·29	3·90	6·96	4·81	7·92	2·10	4·76	4·99	6·15	4·04	14·09	4·68	64·69
	%	22	166	99	70	109	100	149	133	116	98	236	115	121
Rift Valley Province—														
Kitale Agriculture Department ..	Total	0·12	1·24	0·71	4·49	4·82	5·33	8·81	7·78	5·10	9·12	14·59	5·27	67·38
	%	16	79	25	78	75	103	143	117	125	355	793	374	149
Kapenguria, D.C.	Total	0·12	0·16	1·38	4·85	10·52	6·55	8·81	10·92	8·05	9·03	14·32	5·11	79·82
	%	20	14	48	81	135	126	118	138	191	286	628	429	160
Eldoret Experimental Farm	Total	0·05	0·35	0·83	4·42	3·95	3·52	4·76	10·56	1·98	2·69	8·40	4·67	46·18
	%	3	24	38	112	77	99	94	142	62	149	323	242	116
Kapsabet, Baraton Centre	Total	0·04	1·05	5·87	9·52	9·80	4·81	4·36	7·48	9·99	8·18	14·28	6·28	81·66
	%	2	47	139	122	127	78	68	91	174	230	545	272	139
Londiani Forest Station	Total	0·31	0·15	0·51	4·84	4·94	5·51	4·40	10·84	3·17	2·39	17·54	7·08	61·68
	%	26	9	17	81	93	114	82	160	84	121	881	432	141
Kabarnet, D.O.	Total	0·19	0·30	1·70	5·96	3·02	5·68	8·26	13·16	4·36	7·46	23·46	6·36	79·91
	%	20	17	60	83	46	105	101	147	132	336	720	312	152

TABLE A.—RAINFALL FIGURES—(*Contd.*)

Name of Station		Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Rift Valley Province—(*Contd.*)														
Tambach, D.O.	Total	0·30	0·62	1·67	5·79	3·19	5·63	8·54	9·67	2·98	7·85	17·33	7·92	71·49
	%	23	39	49	77	48	147	161	202	112	244	418	278	151
Naivasha Experimental Station ..	Total	0·15	0·85	1·06	3·02	2·45	1·51	1·35	3·35	1·68	6·99	11·65	5·04	39·10
	%	12	70	48	66	64	69	77	167	86	338	448	341	144
Kinangop, Sasumua Dam	Total	1·23	3·00	3·59	10·20	8·36	4·36	3·93	4·18	5·74	16·26	20·29	9·53	90·67
	%	51	105	62	93	87	131	162	150	189	340	302	242	154
Nakuru Meteorological Station ..	Total	0·10	0·17	0·93	3·78	3·13	1·28	3·05	3·91	2·47	5·18	12·07	4·62	40·69
	%	7	14	48	84	73	43	83	93	80	167	262	210	110
Ol Joro Orok Experimental Station	Total	0·13	0·17	0·93	3·74	1·72	2·32	5·14	9·52	3·56	7·30	15·73	10·12	60·38
	%	12	17	55	79	40	65	93	139	104	322	574	388	152
Thomson's Falls Forest Station ..	Total	0·97	0·33	0·28	6·45	2·22	2·75	5·31	11·72	2·83	8·55	15·23	13·92	70·56
	%	75	22	12	134	57	71	98	168	99	658	575	535	178
Perkerra Experimental Station ..	Total	0·24	0·45	2·17	1·36	1·25	1·58	5·07	3·85	0·97	3·73	11·86	5·48	38·01
	%	13	45	111	53	36	80	174	113	60	291	449	354	144
Njoro Plant Breeding Station ..	Total	0·05	0·22	0·77	3·45	3·00	1·93	2·08	6·35	1·49	7·24	16·29	5·83	48·70
	%	5	17	28	69	65	59	47	129	55	367	627	326	134
Molo Pyrethrum Station	Total	0·14	0·17	1·43	3·93	4·52	2·91	3·78	9·05	2·85	4·62	17·91	6·83	58·14
	%	11	16	64	58	90	69	71	126	70	204	551	226	127
Maralal, D.O.	Total	0·14	0·34	1·14	3·72	1·66	2·14	4·12	5·10	0·76	7·27	11·33	1·11	38·83
	%	33	44	76	112	61	100	99	139	64	463	550	140	160
Maralal–Samburu Ranch	Total	0·00	0·00	1·24	2·67	0·11	0·45	1·32	7·09	0·00	6·69	11·66	Dec. not available.	
	%	0	0	76	184	4	52	57	156	0	200	155		
Central Province—														
Nyeri, Mweiga Estate	Total	1·01	2·80	1·11	6·95	2·49	0·40	2·73	4·03	2·96	13·32	15·41	3·57	56·78
	%	47	183	40	120	55	32	180	260	305	503	394	102	177
Meru Agriculture Department ..	Total	1·10	0·24	2·86	12·23	4·01	0·14	0·26	2·35	0·90	56·03	35·65	2·68	118·45
	%	61	26	92	101	64	61	23	247	209	377	215	43	183
Fort Hall, D.C.	Total	0·27	0·56	3·05	7·80	8·11	1·26	0·41	0·82	3·50	17·20	24·39	3·10	70·47
	%	21	39	68	65	106	72	51	94	327	375	325	107	152
Thika, S.R.S.	Total	0·22	0·85	3·77	6·01	0·68	0·57	0·08	0·37	1·22	13·56	16·48	4·87	48·68
	%	17	75	99	73	14	60	13	61	177	567	283	176	147
Karatina, Kagochi	Total	0·30	2·55	1·93	8·18	7·45	2·37	3·00	2·38	4·04	28·94	22·96	9·48	93·58
	%	27	106	70	92	101	166	231	164	348	280	282	206	184
Nanyuki Meteorological Station ..	Total	0·51	0·30	3·94	6·51	1·86	0·43	1·72	4·47	2·51	9·48	11·88	1·45	45·06
	%	67	35	188	139	57	25	68	163	131	309	328	87	156
Embu District Office	Total	0·11	0·43	3·08	11·73	6·35	1·22	0·65	0·77	1·83	24·83	24·20	2·18	77·38
	%	12	47	82	109	102	97	68	71	208	545	336	97	190
Embu, Mwea Experimental Station	Total	0·62	0·13	3·70	6·02	3·33	1·16	0·43	0·16	1·27	13·12	23·11	0·17	53·22
	%	36	17	169	72	55	264	83	52	187	378	262	9	152
Muguga, E.A.A.F.R.O.	Total	0·26	0·28	2·74	6·62	3·85	0·62	1·05	1·00	1·29	6·46	21·93	13·57	59·67
	%	12	17	112	75	52	31	113	120	121	287	388	387	154

TABLE A.—RAINFALL FIGURES—(*Contd.*)

Name of Station		Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Southern Province—														
Machakos, Katumaini	Total	0·04	0·49	1·72	2·71	1·55	0·18	0·00	0·21	0·77	5·37	19·25	6·26	38·55
	%	6	23	44	57	56	106	0	233	335	261	250	147	133
Kitui, D.O.	Total	0·00	3·43	0·87	5·21	4·78	0·00	0·00	0·00	1·85	13·95	27·32	3·37	60·78
	%	0	365	19	55	215	0	0	0	712	436	228	60	150
Ngong, P.C.	Total	0·14	0·15	1·15	5·81	4·43	1·89	1·37	0·89	0·71	7·23	21·41	12·14	57·32
	%	9	7	29	78	82	139	236	116	74	420	612	488	180
Narok Meteorological Station ..	Total	0·33	1·81	1·59	2·78	4·03	1·32	0·02	0·74	1·00	1·00	11·39	14·63	40·64
	%	13	60	40	51	115	123	3	92	120	106	471	526	145
Kajiado, Namanga D.I.S.	Total	0·00	0·26	0·11	5·04	0·00	0·00	0·31	0·00	0·12	3·50	12·41	15·62	37·37
	%	0	10	2	81	0	0	775	0	44	350	396	368	135
Kibwezi, Dwa Plantation	Total	0·00	0·39	0·04	2·41	1·03	0·00	0·00	0·00	0·93	3·60	24·64	5·37	38·41
	%	0	34	1	52	97	0	0	0	775	414	399	100	155
Northern Province—														
Marsabit	Total	2·10	0·20	1·07	8·95	10·51	0·00	1·57	7·22	1·62	10·31	24·52	3·44	71·51
	%	148	30	35	109	258	0	228	938	295	216	432	122	216
Wajir, D.C.	Total	0·47	0·00	0·37	3·50	1·37	0·00	0·00	0·05	0·22	2·09	24·47	0·82	33·36
	%	247	0	47	136	103	0	0	71	92	201	1,015	101	340
Coffee Areas—														
Kiambu, Anmer Estate	Total	0·00	0·43	3·99	6·92	7·18	0·96	1·09	1·42	3·69	8·79	25·10	9·17	68·7
	%	0	23	98	69	99	50	101	115	254	318	391	253	159
Ruiru, C.R.S...	Total	0·28	0·68	3·56	6·84	5·58	1·74	1·16	0·72	3·39	8·64	17·71	6·98	57·28
	%	17	46	98	74	85	92	118	69	224	305	297	220	143
Limuru, Mabroukie Factory ..	Total	0·58	1·29	3·80	8·62	5·99	2·70	1·74	1·28	3·47	14·23	22·97	12·68	79·35
	%	24	55	82	73	61	105	153	81	191	459	403	344	157
Ruiru, Sukari Ltd.	Total	0·00	0·30	2·17	4·78	4·51	2·05	0·16	0·20	1·47	6·20	20·45	7·83	50·12
	%	0	19	70	76	108	178	31	34	216	365	465	325	178
Donyo Sabuk, La Finca	Total	0·00	0·00	3·86	10·71	1·07	0·00	0·00	0·00	0·81	12·17	27·63	5·82	62·07
	%	0	0	78	119	40	0	0	0	245	493	351	139	175
Thika, Bendor Plantations	Total	0·59	1·05	3·09	5·83	1·98	1·65	0·61	0·46	1·11	11·96	18·65	4·37	51·35
	%	48	71	77	64	39	137	76	57	123	450	312	144	141
Kisii Coffee Sub-Station	Total	0·54	6·98	6·53	7·79	7·18	6·17	1·82	4·66	7·18	10·41	19·52	5·87	84·65
	%	22	199	89	69	76	99	44	69	91	197	313	138	113
Mariene Coffee Sub-Station ..	Total	1·19	1·49	2·75	15·12	8·00	0·41	0·34	1·37	2·29	43·86	35·19	2·85	114·86
	%	No averages available.												

Food Production in African Areas

Although the year began with isolated cases of drought conditions, it was not anticipated that this would spread over most of Kenya, but at one stage the April/May (long rains) looked like failing altogether. This position eased in some areas during June/July. However, famine was evident in many areas by August/September and this was to be only the beginning of one of the worst years on record for food production in the drier areas. By the end of 1961 floods had superseded the drought and famine relief to the extent of some £3,000,000 was required. Conditions in nearly all areas were so bad that emergency relief measures had to be set up, especially in the Coast Province and Southern Province. Road communications were cut and famine relief services continued in 1962. Food production in Nyanza, the higher parts of the Rift Valley Province and Central Province were adequate, but distribution was difficult. Many high price cash crops failed, or were destroyed by floods, which aggravated the famine conditions.

Agricultural Exports

The total value of agricultural exports decreased slightly, from £31,394,553 in 1960, to £30,717,239 in 1961.

Exports of the following commodities exceeded £500,000 in value:—

	Position in 1960	1960	1961
		£	£
1. Coffee	1	10,194,898	10,624,891
2. Sisal	2	4,566,033	4,191,840
3. Tea	3	4,410,922	4,004,198
4. Pyrethrum (including extract)	4	3,025,269	3,075,361
5. Meat and Meat Products	5	1,845,175	2,283,341
6. Hides and Skins	6	1,755,745	1,582,366
7. Wattle Extract and Bark	7	962,709	906,527
8. Cotton	8	841,827	629,317
9. Butter	9	650,519	509,715

Crops

Cashew Nuts.—Produced entirely in the Coast Province, the 1960/61 crop sold was 6,705 tons of raw nuts. The average price paid to the producer was 25 cents per lb., 40 cents being paid at the end of the season. At the end of 1961 the acreage under cashew nuts was estimated at 31,500 of which 16,415 acres were in bearing. The number of African cashew nut growers was estimated at 53,270 and their return from the crop at £252,000. The 1961/62 crop was affected by the exceptionally heavy rains at the end of 1961. The buying of this crop did not begin until 8th January, 1962.

Cassava.—Cassava is commonly planted to provide a reserve of food in times of famine. The severe drought in the middle of 1961 caused fear of famine with result that there was a large increase in the acreage planted to cassava during the short rains. In Nyanza Province the area planted was at least doubled. In the Coast Province where the acreage also increased, the popularity of the mosaic-resistant variety 46107/27 continued to grow.

Castor Seed.—Castor seed is the most important export crop of the Kitui District of the Southern Province. Prices paid to producers during 1961 varied from 40 to 50 cents per lb. The total value of sales of castor seed from the Southern Province during 1961 was estimated to be £57,368.

Cereals.—The Board of Agriculture (Scheduled Areas) has supplied the following statistics of the principal cereal crops in the Scheduled Areas:—

Actual production figures for 1960:—

	Acreage	Average Yield Bags/Acre	Total Yield Bags
Wheat	219,815	5·06	1,113,840
Maize (white)	109,891	8·65	951,027
Maize (yellow) ..	8,130	7·21	58,679
Barley	21,368	7·72	165,062
Oats	10,617	6·61	70,228

The estimate of production in the Scheduled Areas for 1961 was:—

	Acreage	Average Yield Bags/Acre	Total Yield Bags
Wheat	221,642	3·39	752,364
Maize (white)	133,236	7·48	997,678
Maize (yellow) ..	14,589	6·95	101,435
Barley	32,289	3·84	124,187

Details of maize purchased by the Maize Marketing Board during the crop season 1st August, 1960, to 31st July, 1961, were:—

	Bags of 200 *lb. each*	
(*a*) *Scheduled Areas*—		
White maize	842,411	
Yellow maize	38,386	
		880,797
(*b*) *Non-scheduled Areas*—		
Nyanza Province ..	527,683	
Central Province ..	99,924	
Rift Valley Province ..	29,202	
Forest Areas	57,682	
		714,491
TOTAL ..		1,595,288 bags

Approximate value: £3,033,927.

Chillies.—In the Coast Province in 1961, 5,762 farmers grew a total of 2,096 acres of chillies. The total production was 102½ tons of dried chillies; the total value of the crop to the growers was £11,170.

TABLE B.—PARTICULARS OF AFRICAN-GROWN COFFEE AS AT 31-12-61

District	Total Planted Acreage	Production in 1961 (tons)		Value to Growers	No. of Growers	No. of Nurseries	No. of Seedlings in Nurseries (thousands)	No. of Factories	No. of Co-op. Societies
		Clean	*Mbuni*	£					
ARABICA—									
Kisii and South Nyanza ..	5,844	772	777	320,416	21,460	61	1,861	26	31
Elgon Nyanza	2,669	445	126	120,100	11,049	18	405	13	13
North Nyanza	577	47	44	17,870	2,513	6	126	3	8
Central Nyanza	110	—	3	180	393	2	110	—	3
Kericho	125	—	11	1,150	331	3	109	—	1
Taita Hills	672	101	—	19,783	2,733	5	187	3	1
Machakos	1,768	135	31	47,756	9,072	34	456	5	8
Meru	11,251	2,398	384	835,073	30,583	58		65	20
Embu	7,272	1,945	353	779,260	36,358	30		24	11
Nyeri	3,945	589	164	254,651	10,645	28	16,000	13	4
Fort Hall	4,038	653	107	256,000	10,085	52		15	12
Kiambu	5,418	419	57	160,502	5,357	33		12	9
Baringo	40	—	—	—	—	—	—	—	—
Nandi	195	10	—	580	—	—	—	—	—
West Pokot	96	—	—	—	—	—	—	1	—
	44,020	7,514	2,057	2,813,321	140,579	330	19,254	180	121
ROBUSTA—									
Elgon Nyanza	78	—	20	1,000	384	2	40	—	2
North Nyanza	72	—	10	500	408	1	17	—	1
Central Nyanza	157	—	5	220	613	2	57	—	4
	307	—	35	1,720	1,405	5	114	—	7
TOTAL COFFEE ..	44,327	7,514	2,092	2,815,041	141,984	335	19,368	180	128

Coconuts.—In 1961 in the Coast Province there were about 33,450 growers of coconuts. The area planted to coconuts was 61,745 acres, of which 47,100 acres were in bearing. The production of nuts was about 16,400 tons. The value of the crop and its products to the growers was about £285,496, the principal products being fresh nuts (£101,456), copra (£97,426) and palm toddy (£86,614).

Coffee.—The total Kenya coffee crop in the 1960/61 season amounted to 32,220 tons, a considerable increase on the previous crop total of 23,394 tons. In the 1960/61 season 24,960 tons of coffee were produced on European estates and 7,260 tons were produced by African farmers. The average payout per cwt. decreased from Sh. 388/84 for the 1959/60 crop to Sh. 315/24 for the 1960/61 crop. The total payout for the 1960/61 crop was £10,157,144 of which £7,538,427 was for European produced coffee and £2,618,717 for African produced coffee. The area planted to coffee in European districts in 1960/61 was 69,970 acres; the average yield was 7.12 cwt. per acre. Full particulars of the production of coffee in the African areas are given in Table B.

Cotton.—The Kenya cotton crop decreased from 19,174 bales in the 1959/60 season to 15,694 bales in the 1960/61 season. Particulars of the 1960/61 crop are given below:—

Bales of Lint 400 *lb.*

	Acres	A.R.	B.R.	Total
Nyanza Province	60,500	11,563	896	12,459
Coast Province	34,423	2,473	762	3,235
	94,923	14,036	1,658	15,694

The prices paid to growers for seed cotton were 52 to 55 cents per lb. for "A" grade and 20 cents per lb. for "B" grade. For the 1961/62 crop the area planted increased to 136,500 acres, but hopes of a much larger crop were destroyed by drought during the growing period and by heavy rains at harvest time.

Essential Oils.—In Nyanza Province six farmers grew 210 acres of geraniums for the production of geranium oil. The oil produced in 1960/61 was 1,792 lb. and its value was estimated at £8,064.

Groundnuts.—Groundnuts are an important cash crop in the South Nyanza District. The surplus for sale from that district in 1961 was 17,297 bags—value £64,638.

Passion Fruit.—A factory in the Sotik area formerly exported passion fruit juice to Australia; but the Australian market is now supplied from Australian plantations. In 1961 the Sotik factory exported 2,827 gallons of juice, but had an additional 9,000 gallons unsold.

Pineapples.—The main African production area is in Kiambu District, where there are 4,000 acres under pineapples. Deliveries of pineapples to the canneries and of fresh fruit to Nairobi from this area totalled 6,594 tons, value about £42,500. European farms, mainly in the Thika District, produced a similar quantity of pineapples, mainly for delivery to the canneries.

Potatoes.—The main surplus of potatoes was produced in the Central Province, where 13,116 tons, value £157,530 were marketed. The main producing area was Meru District, which exported 6,158 tons. The Rift Valley Province produced 5,625 tons of potatoes, nearly half of which came from the Elgeyo/Marakwet District and which were exported mainly to Uganda. The African areas of Kericho District produced a surplus of about 1,000 tons and the Southern Province a surplus of 120 tons.

Pulses.—Recorded sales in provinces are given in Table D and exports from Kenya in Table C.

Pyrethrum.—The production of dried flowers increased from 8,522 tons in 1960 to 10,200 tons in 1961. The number of European growers was 1,138 and the acreage 45,192. The number of African farmers growing pyrethrum was estimated at 26,866, organized as 57 Co-operative Societies, plus 54 individual growers, their total acreage being estimated at 21,854 acres. During the year ending 30th June, 1961, growers were paid Sh. 2/80 per lb. of dried flowers containing 1.5 per cent pyrethrins and the Pyrethrum Board sold the equivalent of 8,382 tons of dried flowers, value over £2,900,000.

Rice.—The principal rice-producing area in Kenya is now the Mwea-Tebere Irrigation Scheme in the Embu District of the Central Province. In 1960 this scheme produced 10,653 tons of paddy, the average yield per acre being 30 bags of 160 lb. net. In 1961, 5,000 acres of rice were grown on the scheme by 1,245 tenants. The production from the 1961 crop is expected to be 10,000 tons of paddy, worth about £225,000. The Nyanza Province produced a surplus of 3,762 tons of paddy, value £85,123, mainly from swamps on the shore of Lake Victoria. Small quantities of paddy produced in the Coast Province were almost all consumed by the growers.

Sisal.—There was a slight decrease in the production of sisal, from 62,619 tons in 1960 to 62,329 tons in 1961. During 1961 the quantity of sisal exported was 57,510 tons, value £4,191,840 giving an average export value of £73 per ton. The area under sisal on European plantations was approximately 272,000 acres. The Machakos African District Council Sisal Scheme produced 5,508 tons of fibre, value £440,682. The African areas of Nyanza Province produced approximately 3,600 tons of fibre and the Central Province 100 tons.

Sugar.—Sugar production increased by 10 per cent, from 29,608 tons in 1960 to 32,606 tons in 1961. Of the total production, the factory at Miwani produced 26,534 tons and that at Ramisi 6,072 tons. The factory at Miwani ground 318,000 tons of cane, of which 61,000 tons were supplied by small growers. The production of jaggery in Nyanza Province increased from 3,000 tons in 1960 to 5,000 tons in 1961. The first sugar refinery in East Africa was installed at Miwani at a cost of £180,000. This plant should shortly be producing refined sugar in bulk, as well as in small packs of refined, cube and icing sugars. At Ramisi, a new sugar mill was installed with a capacity of 35,000 tons of plantation white sugar a year. The area under cane at Ramisi was 11,847 acres of which 800 acres are irrigated.

Tea.—The production of tea decreased from 30,371,154 lb. in 1960 to 27,869,140 lb. in 1961. In 1961 the value of tea exported was £4,004,198 and more than half of the exports went to the United Kingdom. The area planted to tea increased from 37,000 acres in 1960 to 43,243 acres in 1961. By the end of 1961 African farmers had planted 4,075 acres of tea. The production of made tea from African-grown leaf totalled 362,880 lb. The Ragati factory, which processes leaf

grown by African farmers in the Nyeri District, produced 314,348 lb. of made tea valued at £62,397. The average price obtained for this tea at the Nairobi auctions was Sh. 3/97 per lb.

Tobacco.—Virginia tobacco was again grown in the Fort Hall, Ena (Embu), Sagana and Kitui areas. Purchases by the local tobacco company of green leaf from Ena, Sagana and Kitui amounted to 1,486,401 lb. worth £6,405, prices paid to growers being 12 cents per lb. for Grade I, 8 cents for Grade II and 3 cents for Grade III. Purchases of Cured leaf produced by master growers in Kitui and Sagana amounted to 108,627 lb., worth £6,405. The average price paid to growers for the first three grades was Sh. 4/68.

Vegetables, Fruit and Flowers.—Particulars of sales from African areas are given in Table D. The quantities of fruit and vegetables imported during 1961 are given in Table E.

Wattle.—Total purchases of dry bark were 19,678 tons and of green bark 35,941 tons. Exports and local sales of processed bark totalled 4,735 tons, value £123,795. The production of wattle extract was 15,052 tons. Exports and local sales of extract totalled 16,153 tons, value approximately £752,000.

Livestock Products.—Particulars of production from African areas are given in Table D and exports are shown in Table C

TABLE C.—QUANTITIES AND VALUES OF EXPORTS OF KENYA PRODUCTS, 1961

Commodities	Unit	Quantities					Values				
		1939	1958	1959	1960	1961	1939	1958	1959	1960	1961
							£	£	£	£	£
Livestock Products											
Beeswax	Cwt.	1,208	1,756	1,521	870	280	5,162	36,872	33,321	18,650	5,768
Butter/Ghee	,,	21,277	65,716	51,140	49,354	43,012	90,659	972,549	710,610	734,512	616,850
Cattle	No.	—	260	1,363	1,555	795	—	7,587	33,075	63,832	30,862
Cheese	Cwt.	652	749	6,858	3,240	903	2,987	10,675	82,344	42,472	13,960
Eggs	No.	—	2,019,781	3,394,212	6,468,080	5,602,423	—	33,331	50,477	102,376	90,932
Hides and Skins	Cwt.	—	85,760	107,995	131,301	142,521	155,868	1,017,799	1,608,930	1,734,395	1,556,282
Meat—											
Bacon and Ham	,,	1,376	38,911	38,237	22,806	8,170	9,080	406,346	380,965	240,907	115,292
Beef and Veal	,,	—	—	63,454	54,393	47,287	—	—	482,919	447,835	425,469
Extracts	,,	—	722	1,770	1,879	3,242	—	64,633	213,078	169,515	292,829
Mutton	,,	—	—	1,513	2,158	2,861	—	—	14,135	19,260	24,271
Pork	,,	—	—	524	908	1,027	—	—	7,790	13,087	16,221
Tinned	,,	—	—	59,803	54,790	78,240	—	—	1,044,998	892,420	1,350,360
Sheep and Goats	No.	—	280	2,813	422	693	—	831	7,612	1,162	1,661
Wool	100 lb.	15,114	16,665	20,025	21,235	25,657	56,578	309,253	380,988	377,410	437,363
Other Livestock Products	—	—	—	—	—	—	—	—	—	95,493	182,877
Crop Produce											
Cashew Nuts	Tons	32	1,745	1,911	4,809	5,410	1,812	108,792	100,659	323,263	325,424
Castor Seed	,,	—	6,932	3,946	3,310	2,722	—	311,894	177,660	179,500	146,075
Cereal by-products	,,	—	8,702	3,181	5,470	7,020	—	127,515	46,410	88,856	104,616
Coconuts and Copra	,,	215	542	1,727	1,033	1,063	1,561	19,808	117,568	62,625	46,479
Coconut Oil	Cwt.	33,152	1,129	530	902	451	2,346	6,038	3,917	5,366	1,882
Coffee	,,	338,125	500,536	517,545	556,476	643,761	800,827	10,422,722	10,593,790	10,277,852	10,624,891
Coir	Tons	—	760	1,073	1,302	1,407	—	20,602	28,215	48,227	44,116
Cotton	100 lb.	59,677	49,294	70,567	77,998	55,238	124,021	514,846	658,264	841,827	629,317
Essential Oils	Cwt.	*Gal.* 3,660	717	516	1,299	170,437	4,956	20,107	19,369	40,518	57,004
Grain other than Maize and Wheat	,,	14,618	849	27,419	28,793	3,510	4,424	1,999	27,864	36,395	4,828
Groundnuts	Tons	402	1,427	2,041	1,862	1,189	4,442	95,414	119,297	138,276	79,710
Groundnut Oil	Cwt.	6,233	6	1	—	193	680	34	11	3	1,158
Maize	,,	1,007,125	1,956,644	1,086,300	184,027	3,606	222,327	1,867,061	1,092,144	178,418	3,553
Maize Meal and Flour	,,	122,029	11,248	25,380	15,905	22,628	25,450	22,263	31,126	17,196	23,885
Passion Fruit Juice	,,	22,744	*Gal.* 3,240	*Gal.* 2,062	*Gal.* 2,960	*Gal.* 2,928	6,713	2,156	1,609	2,556	2,217
Pineapple Concentrate	Imp. gal.	—	56,808	43,914	48,972	78,773	—	12,475	10,311	14,588	24,097

TABLE C.—QUANTITIES AND VALUES OF EXPORTS OF KENYA PRODUCTS, 1961—(*Contd.*)

Commodities	Unit	Quantities					Values				
		1939	1958	1959	1960	1961	1939	1958	1959	1960	1961
							£	£	£	£	£
Pineapples (tinned)	100 lb.	—	155,322	109,748	94,494	99,926	—	555,351	490,719	443,185	450,683
Potatoes	Cwt.	173,046	43,636	38,836	52,078	70,147	29,199	51,989	38,620	52,297	74,400
Pulses (including Beans and Peas)	,,	130,758	63,592	156,553	138,463	149,836	42,952	129,384	321,154	274,792	298,450
Pyrethrum	,,	55,628	36,125	20,950	62,664	50,667	357,170	524,766	333,272	1,006,154	808,483
Pyrethrum Extract	,,	—	3,435	4,058	5,202	5,902	—	1,289,319	1,862,996	2,019,115	2,266,878
Sesame Seed	Tons	—	588	859	1,469	1,458	—	42,682	52,805	86,515	96,537
Sesame Oil	Cwt.	89,944	412	135	31	75	10,008	2,673	949	215	549
Sisal	Tons	29,163	42,147	51,005	57,043	57,510	442,434	2,227,997	3,458,472	4,566,033	4,191,840
Sugar	Cwt.	81,463	350	680	258	161	50,308	1,160	1,747	836	545
Sunflower Seed	Tons	477	1,550	2,873	1,999	1,577	3,997	52,046	82,851	66,046	53,232
Tea	Cwt.	88,627	162,723	188,461	214,209	195,484	501,732	3,216,977	3,601,643	4,410,922	4,004,198
Wattle Bark	,,	226,716	59,020	123,848	145,241	98,215	72,846	94,615	197,833	232,760	141,283
Wattle Extract	Tons	131,312	379,646	388,786	14,253	16,994	91,439	1,024,166	1,026,252	729,949	765,244
Wheat Flour	Cwt.	63,883	2,580	1,251	9,972	13,687	50,655	8,531	3,887	27,954	39,924
Other Agricultural Produce..	—	—	—	—	—	—	55,649	783,270	226,117	268,987	244,744
						Total .. £	3,228,282	26,418,528	29,778,773	31,394,552	30,717,239

TABLE D.—QUANTITIES AND VALUES OF MORE IMPORTANT PRODUCTS MARKETED FROM THE AFRICAN AREAS (PARTLY ESTIMATED), EXCLUDING NORTHERN PROVINCE AND MASAI DISTRICT

Produce	Unit	Nyanza Province		Rift Valley Province		Central Province		Southern Province		Coast Province		Total	
		Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
			£		£		£		£		£		£
Crops													
Bananas	Tons	948	10,614	—	—	778	15,560	—	—	1,848	15,009	3,574	41,183
Cashew Nuts	,,	—	—	—	—	—	—	—	—	6,371	252,010	6,371	252,010
Cassava	125 lb.	15,686	7,361	—	—	—	—	—	—	47,721	15,170	63,407	22,531
Chillies	Tons	—	—	2	100	—	—	—	—	100	11,170	102	11,270
Coffee (Parchment and Buni)	,,	1,870	381,036	2	524	6,064	2,208,927	148	41,636	101	19,783	8,185	2,651,906
Coffee (Robusta)	,,	20	1,000	—	—	—	—	—	—	—	—	20	1,000
Copra	,,	—	—	—	—	—	—	—	—	1,886	97,426	1,886	97,426
Coconuts	,,	—	—	—	—	—	—	—	—	4,784	101,456	4,784	101,456
Coir	,,	—	—	—	—	—	—	—	—	—	250	—	250
Coriander	90 lb.	—	—	—	—	—	—	389	583	—	—	389	583
Castor Seed	180 lb.	1,224	2,675	—	—	2,412	6,512	933	57,368	3,858	13,232	8,427	79,787
Cotton Lint	400 lb.	12,459	428,915	—	—	—	—	22	615	3,235	81,075	15,716	510,605
Charcoal, Fuel, Poles	—	—	—	—	—	—	93,947	—	1,919	—	38,200	—	134,066
Groundnuts	180 lb.	23,363	88,017	—	—	—	—	—	—	—	—	23,365	88,017
Kapok	Lb.	—	—	—	—	—	—	—	—	125,440	1,898	125,440	1,898
Maize and Maize Meal	200 lb.	598,480	763,425	5,667	7,590	200,009	285,012	982	6,440	3,147	13,047	808,285	1,075,514
Millets	200 lb.	6,404	7,031	—	—	115	350	1,115	2,230	—	—	1,230	2,580
Miraa (*Catha edulis*)	Bundles	—	—	—	—	219,600	65,880	—	—	—	—	219,600	65,880
Onions	Tons	—	—	110	4,070	1,957	4,016	1	50	—	—	2,068	8,136
Palm Wine	Gallon	—	—	—	—	—	—	—	—	846,140	86,614	846,140	86,614
Potatoes (English)	180 lb.	13,054	12,588	32,667	26,250	157,397	157,530	1,493	2,400	89	89	204,700	198,857
Pulses	200 lb.	38,990	75,740	202	450	88,902	155,528	17,019	68,234	711	12,067	145,824	312,019
Pyrethrum	Tons	1,598	279,978	259	75,110	763	142,956	—	—	—	15	2,620	498,059
Pineapples	,,	—	—	—	—	6,535	42,477	—	—	7	465	6,542	42,942
Rice Paddy	160 lb.	52,662	85,123	—	—	149,998	239,996	—	—	1,694	1,778	204,354	326,897
Sesame	180 lb.	5,683	16,656	—	—	—	—	—	—	16,489	28,367	22,172	45,023
Sisal	Tons	—	—	—	—	100	4,230	5,508	440,640	—	—	5,608	444,870
Sisal, Estate	,,	—	—	—	—	—	—	668	8,723	—	—	668	8,723
Sorghum	200 lb.	25,280	18,709	—	—	—	—	1,066	2,370	795	835	27,141	21,914
Sugar Cane	Tons	9,103	10,487	—	—	307	2,686	7	40	—	—	9,417	13,213
Sunflower	,,	8	377	63	1,800	—	—	—	—	—	—	71	2,177
Tea	Cwt.	761	7,690	84	71	2,800	62,397	—	—	—	—	3,645	70,428
Timber	Tons	—	—	—	—	348	8,700	—	—	—	—	348	8,700

TABLE D.—QUANTITIES AND VALUES OF MORE IMPORTANT PRODUCTS MARKETED FROM THE AFRICAN AREAS (PARTLY ESTIMATED), EXCLUDING NORTHERN PROVINCE AND MASAI DISTRICT—(*Contd.*)

Produce	Unit	Nyanza Province		Rift Valley Province		Central Province		Southern Province		Coast Province		Total	
		Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
			£		£		£		£		£		£
Tobacco (flue cured) ..	Lb.	—	—	—	—	13,106	1,346	95,521	7,925	—	—	108,627	9,271
Tobacco (native cured) ..	,,	—	—	—	—	387,507	13,126	141,714	24,000	112,000	5,600	641,221	42,726
Tobacco (greenleaf) ..	,,	—	—	—	—	1,160,100	5,015	326,301	1,391	—	—	1,486,401	6,406
Vegetables and Fruit ..	Tons	—	—	20	300	14,633	246,827	1,466	52,510	916	19,286	17,035	318,923
Wattle Bark	,,	8	50	860	8,600	14,003	96,312	1,643	15,937	100	200	16,614	121,099
Wheat	200 lb.	90	231	8,000	12,000	3,141	6,110	—	—	—	—	11,231	18,341
Wishwa (Maize Bran) ..	Tons	—	—	—	—	—	—	—	—	229	6,076	229	6,076
Miscellaneous	—	—	—	—	—	—	—	—	97	—	100	—	197
Livestock Products													
Beeswax	36 lb.	—	—	—	—	—	—	515	2,782	47	289	562	3,071
Cattle	Head	—	—	28,703	143,550	—	—	28,263	220,883	27,087	235,727	84,413	600,160
Eggs	Doz.	128,177	10,282	10,000	1,250	60,105	8,167	26,779	8,488	36,458	3,645	261,519	31,832
Ghee	36 lb.	16,391	72,112	280	1,540	—	—	336	1,176	—	653	17,007	75,481
Goats and Sheep ..	Head	—	—	—	—	—	—	41,734	46,074	16,106	12,664	57,840	58,738
Hides	No.	249,905	239,972	165,225	81,621	98,686	74,015	211,280	104,860	33,385	24,411	758,481	524,879
Skins	,,	363,278	78,225	401,555	45,103	274,127	55,202	293,901	52,162	109,333	17,315	1,427,462	248,007
Honey	Lb.	—	—	—	—	—	—	3,494	2,176	12,320	1,216	15,814	3,392
Milk and Cream	Gal.	—	3,500	—	—	205,156	22,294	—	—	—	—	205,156	25,794
Pigs (Porkers)	Head	—	—	—	—	628	5,684	—	—	—	—	628	5,684
Poultry	No.	34,724	5,209	24,000	3,600	32,233	7,255	74,038	11,105	7,200	1,800	172,195	28,969
Total		—	2,607,273	—	413,529	—	4,038,057	—	1,184,814	—	1,118,938	—	9,362,611
1960 Totals ..		—	2,665,989	—	310,702	—	3,433,302	—	720,041	—	1,135,935	—	8,265,969

TABLE E.—IMPORTS OF FRUIT INTO KENYA, 1961

		Italy	S. Africa	Israel	Australia	Denmark	Spain	Crete	Lebanon	Total
Apples ..	Wt. (Tons)	629	509	—	196	⅓	—	—	3	1,337⅓
	Value (£)	65,088	41,575		19,481	42			360	126,546
Grapes ..	Wt. (Tons)	—	213	10	½	—	20	23	—	266½
	Value (£)		21,924	2,500	431		4,522	6,250		35,627
Oranges ..	Wt. (Tons)	—	212	353	—	—	—	—	—	565
	Value (£)		15,116	13,790						28,906
Grapefruit ..	Wt. (Tons)	—	—	44	—	—	—	—	—	44
	Value (£)			1,579						1,579
Pears	Wt. (Tons)	173	91	—	½	—	—	—	—	264½
	Value (£)	18,879	8,025		47					26,951
Melons ..	Wt. (Tons)	—	42½	30	—	—	10½	—	—	83
	Value (£)		2,851	2,350			1,216			6,417
Peaches ..	Wt. (Tons)	14	6½	—	—	—	—	—	—	20½
	Value (£)	5,344	1,299							6,643
Plums	Wt. (Tons)	1	6½	—	—	—	—	—	—	7½
	Value (£)	665	2,598							3,263
Pomegranates	Wt. (Tons)	—	—	2½	—	—	—	—	—	2½
	Value (£)			155						155
TOTAL ..	Wt. (Tons)	817	1,080½	439½	197	⅓	30½	23	3	2,590⅚
	Value (£)	89,976	93,388	20,374	19,959	42	5,738	6,250	360	236,087

PART II.—RESEARCH AND SPECIALIST SERVICES

General Husbandry

The difficult year of drought followed by extremely heavy late rains, and of serious Army Worm infestations resulted in the failure of many trials in all parts of the country. In general, results must be accepted with a certain amount of reservation in view of the very unusual year.

Crops.—Potato variety trials were conducted at Ngelani, Njoro, Molo, Eldoret and Iten. The trials were 5 by 5 latin squares with 1/125th acre plots and involved the varieties Roslin Eburru, Roslin Sasamua, Mexico 6, Mexico 8 and Dutch Robijn. The plots were unsprayed but blight was scarce due to the dry season. *Alternaria solani* was fairly common, however, and was most severe at Eldoret. The Mexican varieties gave the highest yields, but have since been shown to have a low market acceptability. Roslin Sasamua was the best variety, and Roslin Eburru was comparable to Dutch Robijn. During the year cooking tests were made on 23 promising varieties.

At Kitale the bulk of the crop trial programme was devoted to further agronomic and fertilizer studies on maize. Good responses were obtained with phosphate and nitrogen fertilizing, increases in yield of 40-80 per cent being recorded over a range of soil types. Plant populations of 12,000 per acre gave the highest yields. In a forms of phosphate trial Japanese fused magnesium phosphate showed residual responses equivalent to those of double superphosphate. Five types of nitrogenous fertilizer were compared and all proved to be equally effective in increasing yields. Split applications of sulphate of ammonia gave no yield increase over single applications and for the first time an application at planting had the same effect as applications at knee height.

In the maize variety and fertilizer trial at Sotik, Kitale Synthetic II was a convincing winner. The optimum manurial treatments were either 2 cwt. per acre superphosphate or five tons farmyard manure. In the season's dry conditions there was no response to nitrogen. There was no differential response to fertilizers according to variety even though varieties usually grown on high, medium and low planes of fertility were deliberately selected for the trial. A nitrogen application trial over three rates and three methods of application gave no differential response to the methods but showed an economic response to the higher rate of nitrogen—346 lb. per acre of ASN produced an extra 897 lb. of grain.

In a time-of-planting trial with maize at Kakamega the advantage of early planting was once again demonstrated. Yields dropped consistently from the first time of planting, as did the percentage of large cobs and also of edible grain. The mean yield from the earliest planted plots was 43 bags per acre.

A trial of five sorghum and one maize variety at Homa Bay showed that the two sorghum hybrids 726 and 610 were easily the best yielders and maize was the worst. The two best sorghums yielded at 3,231 and 3,340 lb. per acre compared to 907 lb. per acre for the maize. The remaining sorghums yielded around 2,400 lb. per acre each. A similar trial in Coast Province also has resulted in 726 outyielding the remaining varieties, and the one variety of maize, this time Local White, again gave the poorest grain yield. The hybrid 610 also did well in this trial, as did TADA, a locally grown sorghum.

In a cotton variety trial at Msabaha in Coast Province three Albar hybrids were compared with UK.51 and UK.58. UK.58 and the three Albars yielded better than the UK.51 variety, which is the present commercial variety, but statistically significant margins were not achieved.

In a second coastal cotton trial the observation was made that seed planted in dry ground had an average germination of 62.7 per cent whilst seed planted after an interval of 45 minutes after there had been a heavy shower, had an average germination of only 21.9 per cent. At two sites cotton and maize grown in alternate rows were contrasted with pure stands of each crop. Cotton matured later in the alternative row cropping scheme, but the cash return from the two systems was very similar. Work at the main cotton station at Kibos, in Nyanza Province, included a breeding programme, variety and spacing trials and a long-term investigation into methods of reclaiming waterlogged land and raising the crop potential of low quality black clay soil. In the variety trial the best yields were obtained from S.47, UK.58, NC.60, NC.58 and N.17—each produced over 1,000 lb. seed cotton per acre. Highest yields in the spacing trial were obtained from the standard commercial spacing of rows 3 ft. apart, holes 2 ft. in the row with two plants per hole and again from the same row distance with holes 9 in. apart with one plant per hole. The long-term reclamation trial produced an average of over 1,000 lb. seed cotton per acre with a full stand in every plot. The treatments included two levels of gypsum, two levels of double superphosphate and the cultivation was 6 ft. bench ridges. Both gypsum and double supers gave increases in yield.

At Busia the cotton trials included tests of varieties, spacing and the applications of sulphate of ammonia and double superphosphate. The varieties at Busia were not the same as those at Kibos. The two Albar strains were the best yielders, followed closely by UK.58 and S.47. In the spacing trial a similar pattern of results was obtained as at Kibos. The fertilizer experiment gave only slight responses, with phosphate raising yield and sulphate of ammonia depressing it.

Sixteen mosaic-resistant cassava varieties were evaluated at the coast for yield, disease resistance and palatability. The highest yielding varieties were 53121/22 with 8.22 tons per acre, and 46106/27 with 7.14 tons per acre. Both are highly disease resistant and palatable. In a different zone, at Molinduko in Central Province, the variety N.146110/8 was much the best and this variety is being bulked for distribution in that area. A collection of over 100 varieties has been maintained at Kakamega.

The groundnut collection of 89 varieties was maintained at Busia in Nyanza Province. The highest yielding variety in Nyanza is Asiriye Mwitunde, but it is suitable only for the oil trade. High yielding varieties suitable for the comestible trade are being selected from the collection. Another station where work on this crop was undertaken is Molinduko, where a number of varieties have given good yields and are being bulked.

In a bean variety trial at Molinduko, the Kenya bean selection Herbert Sproggett outyielded Canadian Wonder and Boston beans by $5\frac{1}{2}$ bags and 3 bags per acre, respectively. In a variety trial at Kakamega with Soya beans a Hernon variety outyielded the remainder, including the Congo variety, which until now has been the best variety in this area. The Hernon variety matured two weeks earlier which may be a very valuable feature allowing Soya beans to be grown as a short rains crop.

In Nyanza and Coast Provinces a number of sugar cane trials are under way. In a trial on Miwani Estate in Nyanza, five different forms of nitrogenous fertilizers did not give differential responses when compared. The five forms comprised urea, NAC, sulphate of ammonia, diammonium phosphate and ASN. In a trial on the Kano Plains clay at Miwani the treatments are designed to test methods of poor land improvement. There were no significant differences in cane weights for the main treatments, but in yield of sucrose per acre, a 4 tons per

acre application of gypsum depressed the yield from 5.597 tons per acre to 5.177 tons per acre, the latter being the yield for a 2 tons per acre application. This result was statistically significant. Not much was added to our information in general about fertilizers on sugar cane, partly due to the season.

Fertilizers and Manures.—Provinces carried out a considerable number of fertilizer trials, both exploratory and rates trials. These are referred to briefly in the Soil Chemistry Section. Reference is made here to a few of the fertilizer trials on research stations. A 3^3 factorial with three rates of nitrogen, phosphate and farmyard manure at Embu was continued in 1961 with no further applications over those given at commencement in 1959, except for reapplication of the nitrogen treatments in 1960, and again in this past season. The crop of maize yielded an average of 19 bags to the acre and once again there was a significant linear response to residual phosphate applied in 1959. Variation of mean yields was from 14 bags per acre for no phosphate to 20 bags for the higher rate at 2 cwt. double superphosphate per acre. In another trial at Embu Tanganyika rock phosphate at 8 cwt. per acre gave an average of 15 bags of maize per acre, compared with 10½ bags for the control. However, the attempt to compare the efficacy of this material with superphosphate has not yet been successful.

A 3^3 NPK trial at Sotik gave no response to N or K, but the residual effect to 2 cwt. per acre double superphosphate applied the previous year was still highly significant. One effect was a marked and consistent increase in lodging in these residual phosphate plots. Another trial with nitrogen, phosphate and farmyard manure, now in its third year, demonstrated that the residual effect of farmyard manure had disappeared this season, but the residual phosphate effect was still significant. Under dry conditions no response to reapplied nitrogen was obtained.

Grass and Fodder Trials.—Apart from the work recorded later in the Grassland Section a number of grassland and fodder trials were undertaken as part of the general research programme in the Provinces. In an undersowing trial in Nyanza it was confirmed that a good grass crop can be established under maize, the two grasses included in the trial being Rhodes and Molasses. However, when these grasses were undersown to beans the grasses smothered the crop. In fertilizer trials on leys at Sotik phosphate has continued to show marked effects in improving production and present efforts are being successfully directed at finding the most economic rates and times of application. Also at Sotik a 3^2 trial to assess the effect of both phosphate and gypsum on ley establishment has shown responses to both with a considerable positive phosphate × gypsum interaction in the first year. In the second year the main effects had disappeared.

Two trials with *Cenchrus ciliaris* were laid down at Mtwapa in 1961. Results to date indicate that on newly cleared land there is only a small response to nitrogen, but on previously cropped land the application of 2 cwt. per acre sulphate of ammonia almost doubles production. The grass was established from both seed and roots, the latter resulting in a better sward, but entailing much extra labour. Higher plant populations gave large yield increases in this first season at least.

A time of cutting trial with Napier fodder at Mtwapa attempted to determine the optimum time of cutting this grass to combine high yields with high protein and low fibre. Cuts were taken when the grass was 3 ft., 5 ft. or 7 ft. high. Results show highest yields from the tallest grass. Between the 5 ft. and 7 ft. stages there is a very rapid increase in the fibre content and a large decrease in the crude protein. Between the 3 ft. and 5 ft. stages there is only a small falling off in the crude protein and little change in the fibre content. The 5 ft. stage of cutting therefore appears to be the best. In another trial at Mtwapa sulphate of

ammonia up to 9 cwt. per acre gave large increases of fodder and also boosted the percentage crude protein. Fertilizer trials with Napier grass were also conducted at various sites in Nyanza Province. Some of these trials have completed two seasons and it has been found that 2 cwt. per acre of superphosphate at planting and 2 cwt. sulphate of ammonia every year has almost doubled the yield from an average of 48 tons per acre to 88 tons per acre in 15 months.

Two legumes, *Centrosema plumieri* and *Dolichos argenteus,* grown with Rhodes grass and Napier grass in Nyanza Province, have provided interesting results. Under a cutting regime with Rhodes they have contributed substantially to increased productivity, but they have not been successful with Napier grass. Six varieties of lucerne were compared in a trial at Sotik and the variety Saladina outyielded all the others by a considerable margin. Saladina has in this and other trials been confirmed as a very successful variety over wide areas of the country.

At Katumani two maize silage trials involving spacing, variety and time of cutting have shown that with seasons of low rainfall spacing has not effect, little is gained by leaving the crop beyond silking or permanent wilting and a long-term variety produces most crude protein per acre. It is, therefore, advantageous to use a long-term variety at a high population as it can make the most of a better than average season while losing nothing in the poor season.

Soil Moisture Studies.—A trial to determine the amount of residual soil moisture left by various crops has produced interesting results at Katumani. Five crops comprising Local maize, Taboran maize, silage maize, beans and fallow were grown the first season. In the second season Local maize and Taboran were used as test crops and in the third season bulrush millet was grown as a silage crop. The first cycle ran through two slightly below average rainfall seasons and finished with the very dry long rains. Throughout there was considerable advantage in using fast-maturing crops with the effect of the first season's crop persisting into the third season. There was also a favourable interaction in using Taboran in the intermediate season.

The second cycle, which started with a moderate rainy season and ran through the very dry season into the very wet short rains, produced exactly the same results except that the interaction with second season, which was a failure, was slight.

This result is unexpected as in the final season the soil was at field capacity for the whole season and residual soil moisture, as was argued for the first cycle, could not be responsible for the differences in the very wet season.

Animal Husbandry

Cattle.—Calf rearing studies continued at Eldoret and Kitale. At Eldoret, early weaning on Unga Pencils proved to be more economical than whole-milk feeding and the early weaned calves received a less severe growth check when put out to grass. At Kitale the effects of feeding various quantities of whole and skim milk to calves were studied and little difference in the growth rates of calves receiving from 20 gallons of whole milk with 120 gallons of skim to 60 gallons of whole milk with 80 gallons of skim were observed.

In a cow feeding trial at Kitale steaming up with concentrates for six weeks prior to calving had no effect on the consequent milk yields, indicating that the level of nutrition before calving was quite adequate for the level of production obtained. Feeding to production for six weeks after calving had no lasting effect on yields although milk production on this treatment during the period of feeding was higher than that on the control groups.

In a trial at Perkerra comparing stall-fed Napier with Star grass grazing using Boran steers and Hereford-cross steers the live weight gains are not as high as those obtained last year, averaging 0.4-0.5 lb. per head per day for all groups. Red Poll steers have, however, gained an average of 1 lb. per head per day since August.

Sheep.—At Ol Joro Orok, the main animal husbandry work was devoted to sheep. The fat lamb production studies showed that the Border Leicester-Corriedale cross makes the fastest growth, but is difficult to finish. The Dorset Horn-Corriedale cross is similarly fast growing, but gives a poor carcass. The Hampshire Down-Corriedale cross, although slower growing than the Border Leicester cross, finishes at a lower live weight and produces a good carcass. The Dorest Horn cross and the Hampshire Down cross were on average about 1¼ lb. heavier than the Border Leicester cross and the Corriedale at birth. Forward creep feeding of oats to lambs appeared to be beneficial up to 50 lb. live weight but after this point consumption rose rapidly without any increase in the growth rate. Further work included measurement of the milk yields of ewes and observations on flushing ewes at tupping time and steaming up before lambing.

Pigs.—The problems associated with high levels of maize and oat feeding were studied at Kitale and Ol Joro Orok respectively; little progress can be reported. At Eldoret work on heavy hog production showed that the removal of skim milk from a maize and skim milk ration after 140 lb. live weight seriously reduced the growth rate.

Grassland

Kitale.—In the plant introduction and nursery work *Trifolium mattirolianum* from Ethiopia, *Cynodon dactylon* from Kiambu in Kenya and "Sorgrass", a perennial type of Sudan grass, have shown outstanding vigour and leafiness.

In an investigation of the breeding behaviour of star grass (*Cynodon dactylon*), the progenies of the best pasture types have shown a considerable variation which suggests cross-pollination and the necessity of having a mixture of clones for seed formation. The progenies of a robust forest type were completely uniform and this type is apparently either self-pollinating or apomictic. A highly stoloniferous and leafy and late flowering type of Rhodes grass (*Chloris gayana*) from West Suk in Kenya, is now being developed as a new cultivated variety.

A preliminary grazing trial has indicated that of several varieties of *Setaria sphacelata* the Lugari variety is best. Clones of *S. splendida* were generally inferior to *S. sphacelata* as ordinary ley grasses. Of the other 11 varieties of grass *Bothriochloa intermedia, Capillipedium parviflorum* and *Eularia geniculata* persisted well and remained dense and vigorous in the fourth year. *Entolasia imbricata,* less persistent, has been high in crude protein throughout the trial.

In selection work on *Trifolium semipilosum* and *T. repens,* final selections have been completed for the time being. Two selections of *T. semipilosum* and four selections of *T. repens* (Bamenda clover) will now be available for testing in the preliminary grazing trials. It seems that as a result of selection, the frequent occurrence of phyllody (virescence) which occurs in unselected clover, has disappeared from both species under present conditions.

In the work on the improvement and testing of lucerne, the first year's results of a variety trial, which had the object of comparing selected Saladina lucerne with other commercial varieties showed that this variety is superior to Booberowie, Hunter River and Hairy Peruvian, which in turn were superior to Provence. Commercial Saladina also compared favourably with all these varieties.

Seven grasses compared for yield of leaf under late season management over four seasons showed Napier fodder as significantly the best, followed by Sigor Guinea, Giant Setaria, Slender Guinea and Molasses, while Rhodes and Columbus grasses gave the poorest yields. General purpose management of a different group of seven grasses over four seasons gave Coloured Guinea, Molasses and Rhodes as being significantly superior to Setaria and Star, while Beckeropsis and Slender Guinea were intermediate. A comparison of sheep and cattle grazing over three seasons gave better yields on the cattle side for Setaria and Molasses, while with Rhodes the yields were similar. However, the sheep grazed more evenly and closely and almost eliminated the Kenya white clover in the Molasses, while the latter grass was almost trampled out on the cattle side.

The fertilizer experiments are producing interesting and useful results. In experiments with lucerne over three years, using K, Ca and Mg, it seems now that all three of these elements are necessary on Kitale basement complex soils for the best growth of lucerne. In other experiments with lucerne and Setaria, and with Kenya white clover and Setaria, the effects of calcium, pure sulphur, gypsum and sodium sulphate were investigated over three years, and highly significant yield increases were obtained from the use of pure sulphur or the other sulphur containing compounds mentioned.

In an "all-1" experiment with Rhodes grass alone, using the six elements N, P, S, K, Ca and Mg, the most severe effect occurred where sulphur was omitted, which resulted in the grass becoming very thin and extremely unproductive. In a similar experiment with Kenya white clover alone, the best results came from treatments which included triple supers plus gypsum, and the poorest yields from those with phosphate alone, or without phosphate, or without sulphur. In this experiment substantial increases in production were obtained of up to 40 per cent by the addition of borax and of zinc in small amounts. Even so, with the addition of all these, the growth of the clover is still not as it should be, and investigations are continuing.

In an experiment with lime on Rhodes grass, and 18 per cent increase in yield was obtained in the first year from a small amount of calcium, as lime, where ammonium phosphate was used instead of superphosphate, to exclude calcium. Gypsum plus ammonium phosphate and triple superphosphate, all gave similar yields to the lime treatment, indicating the probable need for calcium in small amounts for Rhodes grass.

Work on the evaluation of pastures by means of animal production continues. The attempt to assess milk production from pasture which was described in 1960 continued in 1961 on the same pasture—a Setaria ley planted in 1957. In 1961 the effects of fertilizers at the different stocking rates were investigated. The results show that in the prevailing conditions of ample rainfall the use of 2 cwt. triple superphosphate and of 4 cwt. sulphate of ammonia per acre as top-dressings applied between April and July doubled the yield of milk per acre. The extra yield of milk from the paddocks which had received fertilizers was sufficient to recoup the cost of the fertilizers and to leave a surplus balance of Sh. 103 per acre at the heavier stocking rate.

The natural grassland rotation trial has been continued for a fifth year with results similar to those of previous years, when the four-paddock rotation and continuous grazing have given better results than the three-paddock deferred rotation, although the differences have been non-significant.

On the seed production work, new plantings of 9 acres of legumes and 32 acres of grasses made a total of 89 acres under mother seed production on the station at Kitale. An area of 445 acres of herbage seeds was planted this season

under the Seed Certification Scheme in the district. In spite of the ravages of the Army Worm and later adverse weather conditions, 4,500 lb. of herbage seeds have been got in so far on the Grassland Station, although harvesting has not yet been completed.

In the Chemistry Laboratory, the chemical composition of the leaf and stem of lucerne, examined on each of eight occasions when the legume reached the early flowering stage of growth within a 12-month period, showed that crude protein and calcium were higher and crude fibre lower in the leaf than in the stem and that phosphorus was of the same order in both. The ratio of leaf to stem was approximately 54:46 throughout the year.

An examination of the effects of fertilizers on the chemical composition of lucerne at different stages of maturity showed that differences in composition due to the fertilizers are not apparently so important as those due to stage of maturity. These latter include the progressive decrease in the percentage content of true protein-N and crude protein-N, silica free ash, P and S as the plants grow to maturity and concomitantly, the progressive increase in the percentage content of crude fibre and carbohydrate. N and P, N and S and P and S contents are all inter-related throughout growth, and each is related inversely to the whole carbohydrate fraction.

Similar changes in chemical composition with age have been demonstrated in wheat and barley, and it has also been shown that the composition of wheat ears at the time of emergence affords a reasonable guide to the composition of the grain that is eventually harvested.

Studies of carbohydrate (CHO)/N, P and S ratios in relation to the N, P and S status of star grass show that these ratios change in the same way over the same rainfall distribution pattern whether the grass has been fertilized or not. The dry matter production pattern also follows the same pattern as those of the ratios, whether or not the yield of dry matter has been significantly affected by the fertilizers that were applied.

It has been found that the ratio of true protein-N to crude protein-N in legumes, cereals and grasses may remain fairly constant or it may increase very slightly though significantly throughout the growth of these plants. It would appear that some 20 per cent of the total nitrogen contained in plants is in the form of non-protein nitrogen though in certain circumstances this value may be as high as 30 or even 45 per cent.

Katumani Substation.—The year has been a significant one, marked by the completion of much of the preliminary work on annual fodder crops and perennial ley grasses suitable for marginal farming areas in Southern Province. This period of exploratory work has demonstrated the importance of annual fodder crops to smaller individual holdings, and has made available a range of ley grasses of potential value to those areas which can embrace a system of ley rotation. All the long-term experiments on natural grassland have continued, and interim recordings made during the long rains show no significant change in the trends already recorded.

In October, a sectional reorganization brought the Pasture Research Officer, Marigat, to Katumani, with the responsibility of co-ordinating work at both centres. His future programme will be aligned to the overall requirements of the increased area served.

Marigat.—The reseeding experiments have now been terminated. Complete cultivation with a rigid tine harrow has proved most successful as a seed bed preparation on the denuded red soils of the Baringo plains. Scratch ploughing with oxen in thicker bush is only satisfactory if the furrows are not more than 3 ft. apart. *Cenchrus ciliaris,* our most useful perennial, needs careful sowing and covering to obtain establishment. *Eragrostis nr curvula* and *Enteropogon macrostachyus* are easier to establish and have shown considerable promise. A remarkable recovery of perennial grass has been achieved on rocky hill slopes following protection.

Reduction of the bush population, and control of regeneration is a greater problem than reseeding. Large areas of South and Central Baringo have rainfall and soils permitting cropping, and here complete hand clearing is practical and economic, and progress is being made. The "Holt" bush breaker, while smashing down the dense shade canopy, kills none of our species, and unless followed up by a successful burn, encourages the growth of *Acacia brevispica,* and seedling growth of all species. Some success has been achieved by a system of "Holt" breaking—reseeding—protection—burning, but the introduction of such a system into extensive grazing areas presents many problems. A second "Holt" breaking destroys any grass cover obtained and cannot be advised if a fire is needed. "Holt" breaking at different seasons has shown no effect. Hand lopping of bush to knee height has been more successful that "Holt" breaking. Goats have had little effect on the growth of bush here.

Under grazing trials at Chemogoch in South Baringo, the Masaba (Endebess) variety of Rhodes grass has proved to be of better leaf quality, and of equal drought resistance to Rongai and other forms; Masaba Rhodes grass is now being increasingly used in this district. The Kongwa, Mbalambala, Biloela and Kiboko forms of *Cenchrus ciliaris,* with *Enteropogon macrostachyus* have been selected for extended trials in comparison with local *Cynodon dactylon.*

On the Perkerra irrigated alluvial soils the "Chepararia" and "Mpwapwa" varieties of Rhodes grass, with two species of Panicum have compared well with local Star grass. The problem of maintaining a grass-legume mixture is greater under irrigation and results show that fodder legumes might be better grown separately.

Molo Substation.—The establishment of new trials was difficult due to the poor distribution and lack of sufficient rain in the early part of the season, but established trials have produced satisfactory growth.

The major effort has been directed towards subterranean clover regeneration. Experimental results have demonstrated the need for an annual pre-rains dressing of triple superphosphate. 200 lb. to the acre of superphosphate, on a clover dominated sward, gave a sixfold increase in dry matter production of clover and grass—the latter undoubtedly indicating nitrogen fixation by a vigorous clover element. Cultivation has shown no lasting benefits apart from an increased establishment of seedlings which, perhaps because of drought, did not increase the clover content of the stand. Other results, though showing no positive effects, indicate that much lower sowing rates of the companion grass than hitherto used will be necessary for good regeneration of the clover.

Nitrogen and phosphorus top-dressings continue to yield worthwhile results and some interesting magnesium responses have been obtained. In the grass species trial the slower establishing species, Cocksfoot, Tall Fescue, Nandi Setaria and Phalaris continue to show their superiority for long leys over Rye grass.

Coast Hinterland.—At the Coast a programme of experimental work on the hinterland grassland areas is in progress. This work involves methods of bush control including hand and aerial spraying, assessment of grazing capacity, surveys of grazing lands and comparison of grazing systems.

Coffee

Entomology.—The main work during the year was on Leaf Miner, *Leucoptera* spp., although populations remained low and few field spraying trials were possible.

Professor Bess completed his study of the integration of insecticidal and biological control in June. His main findings (which will be published in full) were: (i) the insecticides currently being used for Leaf Miner control do not adversely affect the host/parasite ratio, and (ii) correct timing of spray applications was of prime importance.

A bioassay technique for Leaf Miner has been satisfactorily evolved. Adults are caged on trees in the field for oviposition; leaves bearing eggs are picked and kept at high humidity and constant temperature until the larvae have reached the third instar. The leaves are then sprayed in a Potter Tower and kept for three days in an air stream at high humidity and constant temperature for mortality counts. Using this technique 17 new insecticides have been screened of which three have been selected for field evaluation. Some factors affecting the efficiency of insecticides in current use have emerged which now await confirmation in field trials. Resistance and insecticide/fungicide compatability investigations have commenced.

A detailed study of the population dynamics of Leaf Miner was started in August. This involves measurement in the field of fecundity and fertility and assessment of natural mortality occurring in the different stages of the pest at different times of the year. It is hoped that this study will lead to an understanding of the mechanisms causing outbreaks, a problem intimately connected with control of the pest.

It was found that with an efficient low volume knapsack sprayer, the quantity of pyrethrum needed for the two-stage pyrethrum method of Antestia *Antestiopsis lineaticollis* (Stal) control could be halved for applications of 20 gallons per acre. Work was commenced to develop a new Antestia sampling technique for coffee plantations to replace the present rather laborious tenting method.

Looper caterpillar, *Ascotis reciprocaria* Wlk. was recorded for the first time on coffee in Kenya. The main factors in the life history of this new pest have been elucidated. The two-stage pyrethrum treatment (as used for Antestia) and D.D.T. (for spot treatment only) have been found to give satisfactory control. The species is apparently resistant to the commonly used organo-phosphorus insecticides.

Chemistry.—Results from various trials have shown that soil moisture is a significant factor influencing phosphorus uptake by the coffee tree. Phosphorus levels in the leaves during the rains are increased by grass mulching. Moreover, overhead irrigation applied whenever the soil moisture deficit exceeds two inches has consistently maintained high phosphorus levels in the leaves. Irrigation also gives an enhanced level of foliar nitrogen during the dry season when values are normally minimal.

The long-term study of the influence of environment and cultural practices upon micronutrient levels in the leaf has been continued. While much information has still to be obtained, there are interesting indications of the effects of tree shade and grass mulch upon the levels of zinc and manganese.

Pathology.—Investigations have continued into the use of low volume sprays for the control of Coffee Leaf Rust. During the course of five field trials detailed studies have been made of various field and laboratory experimental methods and results have been obtained which show that Leaf Rust can be satisfactorily controlled with volumes of spray considerably lower than those currently recommended. Using both motorized knapsack mistblowers and tractor-mounted air-assisted sprayers, the control of Leaf Rust achieved by a wide range of volumes and concentrations of a copper fungicide has been investigated and the relationship between these and the amount of copper deposited on the leaf surfaces has been studied. The evidence shows that knapsack mistblowers can be used effectively at 10 gallons of spray fluid per acre and tractor-mounted sprayers at 20 gallons per acre. In both cases, at least 6 lb. per acre of a 50 per cent copper fungicide are necessary. Further work on Leaf Rust is reported below.

Work on the use of soil fumigation to overcome the decline in seedling vigour associated with the repeated use of coffee nurseries has continued. Striking responses to soil fumigation with D.D.T. have occurred in the Coffee Research Station nursery. Seedlings of 18 months old from the fumigated beds showed a twofold increase in the length of the tap root. The extensive development of the root system of plants from fumigated beds poses a problem when seedlings are transplanted into the field however. Investigations into the nematode population of coffee nurseries are in progress, but no particular species has yet been implicated as a cause of the decline.

Coffee Berry Disease.—The only laboratory work undertaken during the year has been that necessary to confirm and extend previous results, and to attempt to assess the susceptibility of all available varieties to the disease. Under laboratory conditions the only varieties found to possess some degree of resistance are Blue Mountain and Columnaris, the latter being the most resistant. Blue Mountain shows some resistance in the field; the behaviour of Columnaris under natural conditions has not been observed.

The 1960 field trials have been harvested and satisfactory control obtained in all districts. Abnormally heavy rains during the latter part of 1961 caused greatly increased incidence of the disease, especially in the "border-line" districts. The 1961 field trials, which are not yet analysed, have shown, however, large yield increases which seem likely to be significant.

Leaf Rust.—Laboratory work on *Hemileia vastatrix* has now been wound up. Many of the results are unexpected, but cannot, of course, be given in detail in this report. In brief, it has been fully established that spore distribution is by water-splash and not by wind; the numerous factors affecting germination and infection have been isolated and studied, and the interactions between them worked out; the existence of inhibition of germination and infection by coffee leaves at one particular temperature (24° C.) has been confirmed; the influence of ageing on spores assessed; the lethal effect of drying on once-wetted spores established; and the existence of a cold-stimulus demonstrated. The relationship of the above to field conditions has been, in part, worked out.

In the field, the 1960 trials have been completed, and without exception, have shown that a very high degree of control has been achieved in all districts; with large increases in yield as a consequence. The 1961 trials, although carried out in a very abnormal year, have so far given identical results, with very effective control and large increases in yield. Precise details of the effect of time of application of sprays in relation to climate and to spore distribution have been worked out, and firm recommendations can now be made with confidence.

Physiology.—In the series of investigations on crop production and overbearing, carbohydrate accumulation and depletion in the coffee plant was studied in conjunction with the growth of the berries. Several important stages in the growth of the berry were found, all of which could be related to the amount of food reserves in the tree.

Stomatal aperture as observed in irrigated and non-irrigated coffee proved to be strongly related to soil moisture content, temperature and nitrogen applications. Growth measurements in the Irrigation Trial showed a marked influence of irrigation in dry periods but no significant differences were observed over a period of one year.

The condition known as "Crinkle Leaf" is under investigation but, in the absence of any firm indication of a possible cause, the main line of study now is a series of trials using Captan, which is known to be capable of suppressing the symptoms.

Field Trials.—Results from two trials, including pruning treatments, have shown that the length of head may be an insensitive measure of pruning severity for multiple-stem coffee trees. It appears that other factors have a far more dominant effect on the yields and that between fairly wide limits the trees compensate for different lengths of head.

An eight-year comparison of rotary cultivation and hand-forking concluded in 1961. A tractor-mounted rotary hoe was successfully modified and found to be more satisfactory than a forked hand hoe, provided that the ground was mulched in alternate years. This advantage was reflected in the yield of coffee and in measurements of the physical condition of the soil.

Increasing effort has been devoted to irrigation research, but results continue to be difficult to interpret. In 1961 the total crop from the irrigated coffee was no more than from the unirrigated, although in the two season aggregate of 1960 and 1961 the most successful irrigation treatment raised the mean annual yield of clean coffee by a little more than 4 cwt. per acre.

Trials in African Areas.—The knowledge obtained from Coffee Variety Trials in African areas during the past decade has enabled rapid and successful development of coffee growing in many districts. It is now possible to recommend suitable coffee varieties for a very wide range of climatic and soil conditions. In some areas it is also possible to define geographically the economic limits for coffee cultivation.

In areas where Leaf Rust (*Hemileia vastatrix*) and Coffee Berry Disease (*Colletotrichum coffeanum*) are of no account, the varieties SL28 and SL34 are planted extensively. Both varieties produce good crops of high quality coffee. If the incidence of Leaf Rust or Coffee Berry Disease is serious, varieties with suitable disease resistance are chosen. The reason is that spraying in African areas, where topography is often precipitous, is frequently difficult to organize. The variety Blue Mountain is recommended where resistance to Coffee Berry Disease is necessary.

Where Leaf Rust is usually endemic, the varieties SL6 and K7 are recommended, because these varieties have been outstanding in variety trials where only Race II of Leaf Rust occurs. Unfortunately in certain coffee areas Race I is often endemic. The Indian S & BA series are known to be immune to both races of Leaf Rust, but their performance in variety trials has often been disappointing. Considerable variation occurs within each variety and crops are usually only moderate to poor; liquoring tests have revealed that S & BA varieties usually produce liquors of inferior quality when compared with SL28 or SL34. Attempts are being made to select individual trees with better cropping and liquoring qualities selected from these varieties.

Pyrethrum

Breeding.—Only 85 new single plant selections were planted on the various research centres, while a total of approximately 300 was under observation. The collection of tested and bulked-up clones covers an area of about eight acres at Molo and five more acres at the other stations. 30 isolated plots were established for the production of bi-clonal hybrids and 14 larger plots for the continuation of the "Sugar Beet" breeding systems were maintained. New hybrids were tested in 23 yield trials distributed over a wide range in the pyrethrum growing areas. New seed production fields were established for M.51, M.54, M.55, M.56, M.65, M.73, O.1, O.3, O.21 and O.22, and some of the existing fields were expanded. Altogether 37 seed plots are now maintained on research stations and private farms. During the year 4,320 lb. of seed were delivered to the Pyrethrum Board for distribution to growers.

Fertilizers.—Ten experiments were continued or planted in various parts of the Highlands. They confirmed on the whole the demand for phosphorus on a fairly wide range of soil types. So far, no other major or minor elements have produced responses of such a nature that their use could be recommended, although calcium and sulphur have on occasion given significant yield increases. Overhead irrigation during the dry year 1960 and the first dry half of the 1961 season proved of great value for increased flower production and toxic content. The disadvantage of continuous pyrethrum cropping on the same land was further demonstrated in the large rotation trial at Ol Joro Orok started in 1947, while pyrethrum following grass leys gave satisfactory yields.

Sisal

Nurseries.—Soil samples taken over a trial area which has been continuously under nurseries since 1950 indicated little variation due to the treatments imposed except that the plots with the highest pH had received sisal waste. The calcium status over the whole trial area had reached low levels ranging from 2.0 to 3.8 m.e. per cent, so agricultural lime at the rate of 2 tons/acre was added. The P level was also very low after the 6th cycle, so the level of the P factor was increased from 180 lb. double superphosphate per acre to 370 lb. This was reflected in a significant increase in average plant weight from 2.8 lb. per plant to 3.4 lb. in the 7th cycle, a response only once previously obtained. When comparing the N-applications over the 7 cycles it was found that in the 3 cycles where N was applied 5-6 months after planting the response was small, while in the 4 cycles where the application was made at planting a significant response was obtained.

Smother nurseries with bulbils planted at random 2 in. to 3 in. apart in 18-in. strips have, at lifting after three to four months, enabled a sorting to take place. This has resulted in a much more even stand when the plants were transferred to a nursery of the normal spacing of 2 ft. by 9 in., and also in a much smaller loss. How long the plants from a smother nursery will have to grow in the normal nursery before they can be lifted for transplanting to the field is as yet unknown. But even if the total time will not have been reduced, a much more even stand will have been achieved.

Plant Management.—The advantage of high plant population has been demonstrated in a population-spacing trial through increased fibre yields. A population of 2,400 plants is showing superiority to 2,000 plants which in turn is superior to 1,600. In the same trial closing the inter-row space from 13 ft. to 11 ft. has induced more rapid growth due to the consequent wider spacings within the rows. This applies equally to double-row or single-row plantings.

Fertilizers.—Under conditions of prolonged drought in 1961 sisal waste treatments in recently established fertilizer trials showed up favourably. About 50 tons of sisal waste applied in 6-ft. strips around the young plants, established in double rows 3 ft. apart, improved soil moisture levels and plant growth. The effect did not show up in older established trials, where the sisal waste had already disappeared. There is evidence that sisal waste should be applied only to young plants either before planting or during the first two years.

A trial with 6-ft. Polythene strips with punched holes into which the sisal plants were planted, showed in the first year a considerable increase in number of leaves. Polythene will not be economic, but the findings may lead to further investigation into the soil covers with plant material.

Herbicides.—A large programme was carried out during the year, mainly for screening herbicides for phytotoxicity. When a 2,2-dichloropropionic acid is applied with a wetting agent, the incidence of die-back is greater than when formulations are used without the wetting agent. The same findings apply to applications of 2,2-dichlorobutyric acid which also induce chlorosis and a check in growth. Work on Simazine and Triazine analogues and substituted ureas gave promising results especially when tested in combinations with other herbicides; the general attempt is to keep clean land weed free rather than eradicate standing weeds and grasses Granular formations were tested at the Station for the first time during 1961.

Plant Improvement.—More work was done during the year than ever before in attempts to obtain improved Agave plants. Seed pods were produced on three *Agave sisalana* plants, more by luck than design, although the poles had been cut early as this was assumed to be one of the essentials for seed production.

Of the original ten 11648 hybrid plants received from Tanganyika in April, 1956, seven poled out during 1961. This is unusual for this hybrid. No poling has as yet been observed in Tanganyika. The poles grew over 2 ft. per week in height and reached 11 ft. within the first five weeks. Lateral buds developed into branches at roughly 16 ft. and the development of the inflorescence is being observed. The average number of leaves grown per plant at poling is about 320 which is considerably less than expected, but which still compares favourably with sisal. Work also continued on comparison of other Agave hybrids with sisal and on selection of plants from the so-called non-flowering sisal plants.

Horticulture

Pineapples.—A survey of the pineapple acreages in Central Province has shown that the publicity and extension work in the African areas, designed to increase production, is taking effect. New plantings are taking place on a substantial scale and these are likely to continue. The annual European plantings remain steady, but the combined acreages should raise the level of production of pineapples in 1962 to more than the 16,000 tons which are required by the canneries for economic running.

The survey has also shown that the fertilizer recommendations consisting of basal dressings of sulphate of ammonia are now in common use in the European areas. In the African areas, however, with exception of the plantations directly supervised by officers of the Department, little fertilizer is being applied and the standard planting distances are still not being employed. This has the effect of reducing by half potential yields from those areas.

The research programme has proceeded as planned. New experiments in 1961 include an irrigation trial to discover the optimum supplementary irrigation requirements of pineapples, and the inter-relation between water supply, plant

spacing, and fertilizer applications. Four soil fumigation trials were laid down on replant pineapple land to determine the effect of fumigation on plant growth and yield. Finally, work has been started to assess more accurately the altitude limit above which pineapples should not be grown for the canneries. Monthly samples are being collected from the altitudes 5,600-6,200 ft. inclusive at 100-ft. intervals for canning and quality tests.

Onions.—Of the varieties tested, only Bombay Red, Bellary, Round Red and Egyptian Flat produce an onion which has the qualities required by the local market. The yield comparisons between the three red varieties have been inconclusive. The suitability of Egyptian Flat for Kenya conditions must be regarded as not fully proven until further trials have proved the reliability of its bulbing.

Macadamia Nut.—All Macadamia trees in Kenya are seedlings. These are inherently variable in growth, yield and quality, and are of little commercial value. In order to produce a uniform type of tree for commercial production a number of individual trees which exhibit the best characteristics have been selected. These are being propagated and will be planted in blocks in order to study their performance over a number of years for final selection of the best types for commercial plantations.

Strawberries.—During the year 11 varieties of strawberries were received from the United States of America and a few reached sufficient size to crop in October, though due to the inclement weather it was not possible to judge the quality. The results of a fertilizer trial over three years gave no significant response from the use of artificial fertilizers and the general poor yield showed the necessity to use freshly imported planting material.

Mushrooms.—A trial completed using fortified pig manure gave a yield of 2.08 lb. per sq. ft., which was an increase of 16½ per cent over the yield produced using synthetic compost.

Vegetables.—Artichokes, variety Gros Camus Bretagne, received during 1960, were sent to Covent Garden, where they received a very favourable report.

Dioscorea.—The diosgenin assay figures for two-year-old tubers did not show a significant increase over that of one-year-old tubers. Three strains of *D. sylvatica* were received from Messrs. Boots Limited (U.K.) and planted in April and have since made satisfactory growth. Trials have also commenced to investigate the value of selection, the optimum size for planting material and the altitude range for the crop. To date *D. balcanica* has proved the most vigorous of the species tried, and on this account would at present produce the most diosgenin per acre.

Geraniums.—Observational trials carried out during the year have proved conclusively the value of dipping cuttings in a 0.5 per cent Captan dip and root hormone powder Seradix No. 2, if optimum rooting is to be obtained. The use of sand beds was also found to be unnecessary if suitable well drained land was available.

Plant Pathology

Diseases.—1961 was even drier than 1960, except for the short rains floods which caused so much physical damage that diseases tended to be overlooked. As a result, only 306 disease specimens were submitted for diagnosis compared with 350 in 1960 and 638 in 1959. A detailed survey of bacterial wilt (*Pseudomonas solanacearum*) was conducted in Central Province and 678 smallholders' crops were examined. The disease was present in rather less than half the crops examined and its incidence was generally low during the relatively dry long rains season. A similar survey during the abnormally wet short rains was

impossible because of the floods and the general masking of bacterial wilt by exceptionally severe blight (*Phytophthora infestans*). The potato variety "Roslin Eburru" which contains four major genes for blight resistance was released in July but succumbed to blight in November and Blight Race 1234, which is new to Kenya, was identified on it. Studies on sugarcane smut (*Ustilago scitaminea*) were continued. The varieties Co.331, Co.421 and B.41227 (an irrigation cane) show a fair degree of resistance to smut in the field. The varieties Co.270, Co.290, Co.301, Co.312, Co.396 and Co.419, which are all cultivated in Kenya have been shown to be susceptible. Commercial stocks of Co.421 are generally contaminated with Co.270 and this susceptible variety gives a false impression of the degree of resistance of Co.421. There was an increase of bud disease (*Ramularia bellunensis*) and the physiological "false bud disease" on pyrethrum during the short rains. Work on the propagation and selection of woodiness virus resistant passion-fruit continued.

Cereal and Coffee Diseases.—The reports of the cereal and coffee pathologists will be found in the Plant Breeding and Coffee Sections.

Fungicide Investigations.—Seed dressing trials were conducted on beans and maize, the two crops which gave inconclusive results in the 1960 trials. Unfortunately, results were again inconclusive and, although the value of fungicidal seeds dressings on these crops has still to be demonstrated, there is insufficient evidence to justify alterations to current practice and their use is still recommended.

Nematode Investigations.—Dr. John P. Hollis, Fulbright Scholar, has commenced investigations involving the use of soil fumigants to assess the effects of nematodes on pineapples, sisal, tea, coffee, beans and pyrethrum. He is also doing nematode survey work.

The Potato Development Programme.—It has been decided to abandon major gene resistance as a means of controlling blight (*P. infestans*) and to concentrate on polygenic resistance. This decision was accelerated by the extremely rapid appearance of Race 1234 following the release of variety Roslin Eburru which contained four major genes for resistance. A temporary ban was placed on further imports of potato material for trial while the dangers of both the new virus "Y" and the second compatibility group of blight were assessed. The Potato Research Advisory Committee was formed and its inaugural meeting was held in October.

Legume Bacteriology.—Eighty-eight extended evaluation trials were conducted and useful data were obtained from 70 of them, in spite of drought problems. These trials were modified as a result of the 1960 series and fewer trials of a rather more complex design were laid down, using nitrogen fertilizer controls and imported inoculants as additional treatments. These trials are providing valuable data on the effects of legume inoculation and the extent of natural nodulation of legumes in different environments throughout Kenya. More complex trials were conducted in an attempt to determine the amounts of nitrogen fixed by various legumes, but most of these were spoiled by drought; only one, involving lucerne, produced a result which showed that nitrogen-fixation was comparable to that of temperate regions. During the year, 57 orders were received for 314 units of inoculant sufficient to inoculate approximately 9,000 lb. of seed.

Seed Testing.—A record number of 3,086 samples of seed were received for purity and germination tests. Testing for the wheat certification scheme, for export certificates, etc., continued. Research included studies on storage techniques to improve seed longevity and dormancy of pasture plant seed studies. The seed testing laboratory has now joined Region 5 of the Regional Referee Testing Scheme sponsored by the International Seed Testing Association. This region includes Australia, New Zealand, Japan, New Delhi, Salisbury and Pretoria.

Entomology

In Coccid taxonomy, work continued on the description of mealybugs from Africa South of the Sahara. This involved the re-examination of much accumulated material. 20 new species were described. A survey of the cytology of some local mealybugs was made jointly with Prof. W. S. Brown, of the University of California. Routine identifications for various territories continued.

In an experiment at Mombasa admixture of malathion dust with stored maize at eight parts per million gave good control of *Tribolium castaneum* and was better than treatments where external spraying or dusting of the sacks with malathion was carried out. Spraying of the complete upper surface of each sack was better than no treatment, but was much inferior to admixture with the grain.

The search for *Trogoderma granarium* continued and was extended to the coastal area south of Mombasa and to Taveta. An assistant was posted to Kisumu to inspect cargoes from Lake ships. Special treatment of incoming cargoes of maize from Rhodesia was carried out to ensure that Trogoderma infestations were eliminated and these involved spraying of rolling stock transporting the maize to the fumigation site. Trogoderma searches in Tanganyika gave negative results.

A trial of a pyrethrum formulation in a Swing-fog applicator against a heavy moth population in maize stored at Mombasa gave spectacular results resulting in virtually no flying insects for 48 hours.

A crib experiment, carried out at the Scott Agricultural Laboratories, tested three strengths of pyrethrum-piperonyl butoxide in marc and two strengths of Lindane based on diatomite. The experiment began late in the season and the insect population differed from that in previous trials in that *Sitophilus zea mais* did not build up large numbers in the untreated maize. An infestation of *Sitotroga cerealella* was experienced, starting in an untreated compartment, and attended by a high population of *Anisopteromagus calandrae*. This parasite appeared to suppress pest populations in other parts of the experiment.

After seven and a half months the experiment was concluded and analysis of damage to maize kernels was made at three levels at the exposed side of the crib and also from the centre. Inside cobs were significantly less damaged than cobs from the outside. Untreated maize from inside was worse than all treatments which did not vary significantly among themselves. On the exposed sides none of the pyrethrum treatments differed from untreated though both Lindane treatments were very effective. 1 per cent Lindane was better than 0.5 per cent at the same rate. A recommendation for crib treatments is 4 to 8 oz. of 1 per cent Lindane to 9 cu. ft. of cobs with the heavier rate applied on the exposed sides. Pyrethrin dusts are suitable for unexposed maize but are not effective where there is exposure to the sun.

In the field the most serious problem was that of Army Worm. This was reported first in March from Nyanza with the outbreak spreading northwards into the Trans Nzoia and Uasin Gishu Districts. Nakuru District was heavily attacked with subsequent infestations near Thomson's Falls, Nanyuki and finally in Nyeri in May. A late infestation occurred in the Southern Province and Nairobi area in April, two to three months later than usual. Army Worm is normally limited to altitudes of 6,500 ft. and under, but possibly due to hot dry conditions the infestation reached a level of 8,300 ft., thus infesting many areas where it was not expected.

Damage to young maize occurred in most districts but was reduced by tractor and aerial spraying. The standard recommendation of 1 lb. of D.D.T. per

acre had to be replaced by other insecticides due to shortage and these included chlordane, toxaphene, endrin, dieldrin, aldrin, B.H.C., diazinon and malathion. Dipterex and pyrethrum were used experimentally: both gave rapid kills, but had little persistent effect. Cattle dips were used extensively, but those based on B.H.C. did not give much persistency and aerial spraying of B.H.C. was not very satisfactory.

A polyhedral virus was collected at Koru and was used experimentally. It is effective against small caterpillars but large caterpillars may pupate before showing symptoms. A second infestation occurred in November and December and did a little damage to grazing. It began near Nairobi and in the Machakos area and gradually spread northwards. It gave opportunity to further test the use of virus and gave useful confirmatory results. This second outbreak was heavily parasitized by several species of Tachinid flies, Hymenoptera, a nematode and possible bacterial and fungal diseases.

The close co-operation achieved with the field staff, particularly in Rift Valley Province, was noteworthy and experience gained may form the basis for a control team organization in further outbreaks.

On cotton in Nyanza numbers of most pest species were markedly affected by both the drought of June-July and by the abnormally heavy rains of October-December. The drought caused a reduction of numbers of most pests below the normal level. Among stainers there was a greater proportion of *Dysdercus nigrofasciatus* than *D. superstitiosus* and the incidence of Tachinid parasitism was low. Numbers of spiny and American bollworms were lower than usual. Due to the drought, however, cotton plants were unable to replace buds damaged by these bollworms, so that the effect of their attack was as severe as usual. Aphids increased to large numbers in late June accentuating the effects of the drought. The second flush of bolls produced in the October-December rains was severely attacked by stainers, principally *D. fasciatus*, and by pink bollworm and false codling moth.

In insecticide trials on cotton, Sevin 10 per cent dust was found to give better insect control and higher yields than 3 per cent gamma B.H.C./5 per cent D.D.T. dust. A dust containing 3 per cent gamma B.H.C./5 per cent Toxaphene gave poorer results than the standard B.H.C./D.D.T. dust. Sevin sprayed at $\frac{1}{2}$ lb. per acre was found to be as effective as D.D.T. at $\frac{1}{2}$ lb. per acre and more effective than Toxaphene at 1 lb. per acre. In plots on peasant farms in South Nyanza, an interval of 14 days between dustings was found to give less effective pest control than an interval of seven days. In Central Nyanza trials showed that the use of insecticide was of value only on cotton planted in February or March; April planted cotton gave poor yields whether dusted or not.

The use of 50 per cent Dieldrin wettable powder as a seed dressing was found to protect April sown sorghum against sorghum shoot fly.

A survey carried out on passion fruit on European and African farms in the Sotik-Kisii area gave support to the theory that wind-borne insects, possibly aphids, are vectors of woodiness disease. Other causes of "woodiness" symptoms were also investigated.

In the Coast Province most of the work was done on cotton. A range of miticides was tested against cotton red spider mite, and it was found that two applications at a 12-day interval brought about a satisfactory control. An attempt was made to find an alternative to 3.5.0 cotton dust but did not meet with much success. Of the sprays used, Endrin was the most successful. The influx of stainer-bugs onto cotton during the year was normal, but very heavy outbreaks of

American and Spiny bollworms were recorded at Galole and on the lower Tana. Pink bollworm was a serious pest in Coast Province during the year and must cause concern.

The usual heavy attacks of maize stem borer, *Chilo zonellus*, occurred; the length of its life-cycle was established and promise was shown in the use of D.D.T. dust in its control.

In the biological control field work continued on Dactylopius on prickly pear and new liberations were made in the Coast Province. Lantana continues to be infested with Seed fly and Teleonemia, but with rather disappointing results.

In Nyanza observations continued on the pests of Striga with a view to controlling it by biological means.

Plant Breeding

The development of new varieties, and continuing changes of variety necessitated by rust, combined to produce considerable changes of pattern in the wheat sowings this year. Some 80 per cent of the acreage was planted with varieties only released in the last four years. The acreage fell slightly in 1961, but by the end of September harvest prospects looked better than ever and wheat production should have run at a high level. However the extremely wet weather from October to December caused nothing less than disaster. In the medium altitudes the crop was well formed by the time the heavy and sustained rain arrived and the main effects were delayed harvest, bad sprouting and weathering. Higher, in the later areas, the wheat was younger and leaf disease spread so thoroughly that the grain failed to form in much of the crop. Barley was similarly affected. However, such had been the extent of the dry season, and the low rainfall through to September, that very little rust was evident on wheat this year. It is therefore all the more tragic that such exceptional late rain turned a very hopeful season for wheat into a catastrophe. The harvested grain is poor in quality, the amount is less than half Kenya's normal production, and the country is left in a very difficult position for seed supplies for the 1962 plantings.

Maize has also been damaged by the weather in some areas, but continuing success with Kitale Synthetic II in western areas and with Taboran for drier areas gives considerable encouragement. At the Coast a new race of Tropical American Rust attacked the resistant stock being multiplied late in the season, but the further distribution of this maize will be continued for 1962.

Wheat Breeding.—In the wheat breeding programme the main point of concern has been the partial loss of stem rust resistance in derivatives of *Triticum timopheevi*. The new variant of the stem rust fungus has been found both in farm crops and at the Plant Breeding Station, and has necessitated the rejection of various new varieties that hitherto held considerable promise. That this breakdown of resistance is not complete is illustrated in crosses involving C.I. 12632 and Wisconsin Supremo in which resistant selections are still being obtained. *Triticum timopheevi* itself remains completely free of all three wheat rusts. Crosses made during the year were aimed mainly at adding rust resistance from other species to the best existing varieties. Small multiplication plots were severely culled of poor material, but the reduced numbers of varieties going forward are of considerable promise and these include some new Kenya varieties which are performing very satisfactorily. Material in field scale multiplication was reduced considerably, but four varieties merit special mention, namely Mexican 50, 187 B, Columbian 3475 and Gala 54 x Kentana-Rio Negro. These look very hopeful for mid and low altitudes; three Minnesota lines are also proving extremely attractive for use in the higher altitudes.

The introduction of micro-tests for baking quality has moved forward steadily, and the procedures involved are now being extended to wider ranges of test material. Meanwhile it is a point of considerable satisfaction that almost half the wheat acreage in 1961 was planted with the varieties of good baking quality. This is a very marked improvement from as little as two years ago, and it is very much to be hoped that it can be maintained.

Wheat Pathology.—Stem rust was at a very low level, with outbreaks scattered and light, and it is therefore ironic that a new and damaging sub-race should have made its presence felt during the 1961 season. A change in the rust spectrum was suspected when lines having the *T. timopheevi* resistance began to rust; a new variant of race 40, known as 40T has been shown to be the cause. Examination of past records has since shown that 40T was present in limited quantities in 1959 and there is some evidence that it first arose in the Northern Province of Tanganyika.

Unfortunately freedom from rust has not resulted in healthy crops. The prolonged rains late in the season, in addition to making harvesting difficult, led to a heavy build-up of three other diseases, namely Glume Blotch, Septoria Leaf Blotch and Leaf Blight. These three, in various combinations, have been responsible for the total loss of many crops and some degree of damage to almost all others. There has been unusually heavy production of perfect stages by the causal fungi.

Barley, similarly, has suffered heavily from leaf diseases. The degree of carry-over of these diseases, all of which are soil borne, will depend on the weather during the 1962 season, but could be serious if rains are heavy.

(*a*) Western Kenya

Maize Breeding.—The West of Rift maize breeding project continued to make steady progress in the production of synthetics and hybrids trials were seriously affected by the unprecedented Army Worm, early drought, severe hail, and late excessive rain. Despite all this, a few trials have given highly significant results, and most were brought through sufficiently well to be able to make decisions for practical breeding purposes; but some were ruined completely. The breeding plots suffered little damage and the improved vigour and appearance of some of the inbreds was very pleasing.

Some 3,000 acres of Kitale Synthetic II were grown, mostly limited to 50 acres per farmer and mainly in the Trans Nzoia. For 1962 planting the variety is released from departmental control, seed is available through normal commercial channels, and the recommendations made for 1961 are confirmed by results of trials and visits to farmers' crops.

In the back-crossing programme to transfer the dwarfing gene *brachytic II* to Kenya maize, the first back-crosses combine the big cob of Kenya Flat White with the high row number and deep grain of the Corn Belt dent to give very good yields. From the testing of a wide range of material, four United States lines have been found with apparent complete local resistance to rust (*Puccinia sorghi*). A number of Central American varieties with a high level of resistance have also been selected.

The best of the first Kitale-produced experimental single cross hybrids have yielded 30 per cent above Kitale Synthetic II. One in particular has suitable seed for use as a seed parent in the production of double cross hybrids.

The maizes Costa Rica 76 and Ecuador 573 in crosses to Kitale Synthetic II have outyielded the latter by 40 per cent. Though these varieties both have had faults it will be possible to set up a reciprocal selection programme with them.

(*b*) Southern Kenya

The need to produce more reliable yielding food crops for the dry areas was well illustrated in Machakos District in 1961. The average maize yield for the district was less than one bag per acre, and a total of 147,000 bags of maize was distributed as famine relief. Consequently much attention was devoted to the problems of bulking and distribution of the new short-term maizes. In October Taboran maize became available commercially, and an encouraging number of small 5-lb. packets were sold to African farmers in the dry areas. Bulking of Katumani Early Synthetic, a slightly later maturing maize than Taboran, began at the Machakos Farmers' Training Centre. A new short-term white maize, Katumani Synthetic II, was formed during the year, and is now in preliminary trials.

Further evidence was obtained of the ability of short-term crops to conserve soil moisture. This confirmed the value of selection for earliness in maize and other crops for dry regions with two short rainfall seasons per year. The basic breeding plan for the production of short-term synthetic maizes continues, and preliminary selection of quick maturing cow-peas began. In addition, the quick-maturing TADA sorghum and Herbert Sproggett bean continued to give satisfactory results in yield trials.

Soils and Agricultural Chemistry

Field work was completed on the Ewaso Ng'iro and three-fifths of the Solai soil survey projects, in all some 500,000 acres being covered. A draft 1/50,000 scale soil map for the Ewaso Ng'iro project was completed in which 24 soil series, six soil complexes and eight miscellaneous land units were recognized. In addition an appraisal of the suitability of the soils of the irrigable portions of the whole Ewaso Ng'iro catchment was prepared for appending to the report on that river system being published by the Ministry of Works. This includes a 1/50,000 scale irrigation suitability map of the upper part of the catchment.

Laboratory data were accumulated on over 5,000 samples of soil by the Mehlich procedures. These samples came from soil surveys, field fertility experiments and departmental extension activities. A considerable improvement in the territorial coverage resulted from the increased use of our facilities by some District Agricultural Officers in peasant-farmed areas for collecting basic information on the soils of their districts.

The mechanism of mineral nutrient fixation, retention and release in the soil received further examination. The investigations involved particularly concerned the ion exchange properties of laboratory prepared clay-like alumino-silicates and hydrated oxides of iron and aluminum and the effects of ignition on soil phosphate availability. As a result of these investigations it has proved possible to characterize the main sources of contribution to the base exchange capacity of clay, and to relate its nature and magnitude to the ratio of aluminium to silica in the clay, to the presence or absence of magnesium or calcium salts in the reaction medium, and to the degree of substitution of hydroxyl groups in the sesquioxide hydrate constituent of the clay by phosphate. Phosphates which contribute to base exchange capacity are so tightly bound to clay that they cannot effectively be liberated by dilute acid extraction. The ignition studies showed that phosphate thus held, as well as phosphate held in organic forms, is released by the ignition methods which have been widely used for the measurement of organic soil phosphorus. The dilute acid extractability of soil phosphate in fact increases in step with the dehydration of the clay minerals which results from ignition.

The X-ray defraction equipment was assembled ready for the arrival of a clay mineralogist.

Webb-Hewitt pot tests were undertaken on 16 soils. Nine of these were from the Solai soil survey project, the main deficiencies found here being nitrogen, phosphorus and sulphur. No indication was found of the copper deficiency which is so characteristic and which has been found to occur so widely in neighbouring parts of Nakuru District. Seven soils came from the Ewaso Ng'iro soil survey and these were found mainly to lack nitrogen and phosphorus.

Major element nutrient studies of sisal and pyrethrum were initiated. These necessitated a search for suitable sand for culture work, which led eventually to a site in the Arabuko-Sokoki forest in Coast Province as the best-known source. The sand found there proved suitable without prior treatment for work on the major nutrients other than calcium. A water culture investigation of the trace element nutrient of sisal also was initiated.

Fertilizer trials under the Swynnerton Plan continued. The emphasis remained on the determination in rates trials of the optimum rates of nitrogen, phosphate and manure application and of the long-term effects of repeated applications of these. Exploratory work was continued in those areas where the fertility response pattern still needs general elucidation. Its extension is projected to areas where the geographical coverage of earlier exploratory work has been inadequate and to nutrients, other than N, P and K, which laboratory findings show to be deficient. Intensification of the investigation of the needs of soils which require liming for successful production of general farm crops is being undertaken.

The long-term lime trials continued, all three of the retained sites remaining under grass. Graduated calmag applications were introduced, with a view to examining the effect of a wider range of Ca/mg ratios in the soil on crop growth. Leaf samples from previous harvests in these lime trials were analysed. These showed the expected increase in N, K, Ca and Mg and decrease in Mn and Al following fertilizer and lime applications.

Soil moisture investigations continued, particularly in connexion with the development of crop sequences for semi-arid areas, the improvement of the irrigation relation of problem soils, the control of water application in irrigation trials and the measurement of drainage effects.

Moisture studies associated with the crop sequence investigations, showed that the soil concerned can retain quite an appreciable amount of water from a previous fallow but it drains out remarkably dryly even when fully protected from loss by evaporation. The benefits to succeeding crops from some of the field treatments have been so much larger and so much more persistent than seems possible purely on the basis of moisture storage factors that the phenomena need comprehensive investigation.

The water acceptance rate of an excessively permeable soil was satisfactorily and adequately reduced in the field for surface irrigation to be possible, simply by dragging a weighted pipe designed on the basis of laboratory compaction studies along the furrow bed behind the water. On the other hand, the too frequent irrigation of onions which has been necessary on another soil was found due to an extremely adverse size distribution of the mineral particles of the soil. This can only be overcome by raising the organic matter content of the soil in the field to an impractically high level.

Wheat protein investigations continued to be concerned with electrophoretic and chromatographic techniques for the fractionation of gluten derivatives. Using chromotography one major and three minor components of a sulpho-crystenyl gluten preparation were isolated but the overall recovery of applied material was low.

The fine dry harvest weather which prevailed during the harvest of the wheat maturation trials yielded wheat of uniformly high strength though some tendency was apparent for the late sowing, both of Regent and African Mayo, to be stronger than the early.

Several essential oil samples were distilled for quality appraisal. Sufficiently encouraging reports were received on some basil oil for further propagation of plantings to be justified. A lime oil sample received a less favourable report. Work was started on diosgenin estimation in connexion with the trial plantings of diosgenin-bearing yams.

Irrigation

Mwea.—As a result of a review of previous experimental work the research programme was modified for 1961, effort being concentrated on a narrow range of important projects.

The rice variety collection was maintained whilst statistical trials with the most promising varieties continued. Fertilizer trials, including a time of application of nitrogen trial, were again undertaken. The chief need with fertilizers is at the present time to study the requirements of the rice crop throughout the variable conditions of the main rice area. On the red soils work continued with a narrow range of potentially important crops comprising onions, coffee, tea and certain orchard crops. No responses to fertilizers have been obtained in reliable onion trials. Three further varieties of coffee, comprising heterogeneous material, were planted in 1961 and quality in addition to existing rust resistance will be sought in these. The tea trial is progressing well but much remains to be learnt about this crop, particularly on the quality side.

Herbicide trials were undertaken to control acquatic and semi-acquatic weeds. Good control of Reedmace (*Typha augustifolia*) was obtained with Dalapon but at uneconomic cost.

The most important project initiated during the year comprised the establishment of five experimental holdings of three acres each, with an acre each of food crops, annual cash crops and semi-permanent crops and trying out three methods of irrigation—overhead, furrow (on inclined plane) and level basins (flood.) Weed infestations have shown up as the main problem so far in the exceptionally wet short rains season.

Perkerra.—Studies on the onion crop continued. Onions planted from sets outyielded those planted from seedlings by 4.04 tons per acre. Light waterings at five-day intervals proved to be better than heavier waterings at ten- or fifteen-day intervals and increased the yields by 2.97 tons per acre. The remainder of the trials were badly upset by the disease known as "blast" which reduced the yields by three or four tons per acre. However, the results indicated that if the disease can be controlled good responses to farmyard manure can be expected and that onions can be produced successfully on the heavy soils. In a storage trial, onions were successfully stored in chopped grass for a period of 16 weeks, the total losses during this period amounting to 20 per cent by numbers and 27 per cent by weight compared with 40-50 per cent losses with other treatments.

A beef trial at Perkerra is reported under the Animal Husbandry Section.

Galole.—The main result from cotton trials demonstrated the advantage of early planting. There was a steady decline in yield from 1,731 lb. of seed cotton to only 926 lb. from four spaced plantings dating from 4th April to 9th May. Following on a preliminary study of the 75 varieties of groundnuts a statistical trial in 1961 of the five best selections indicated the marked superiority in yield of the variety known as 83.

Kano.—An irrigation trial on the cotton crop incorporated different planting dates and different watering regimes. The significant results related to times of planting. Mid-January and mid-February plantings outyielded the mid-March planting. No significant differences occurred between the watering regimes, which consisted of application when available water had dropped to 75 per cent, 50 per cent and 25 per cent of maximum. However, all three regimes beat control, a no-watering treatment. The most economical treatment would appear to be the third watering regime combined with mid-February planting, since the later the planting the less time the crop needs to be watered.

Agricultural Machinery Research and Development

Agricultural Research Officer (Engineering), Nakuru

Trials.—Trials of the Landmaster were carried out at Nyeri in an attempt to break up a Kikuyu grass ley. The kill was successful, but drought conditions were so severe that the grass would probably have died in any case. The maize crop was a failure due to drought, and between drought and floods no further trials have been possible. On the results obtained, and from E.A.T.U. figures, a paper was written outlining a possible application of this type of motorized cultivator.

Trials were made on Doum Palm leaves with the corrugated rollers designed for sisal decortication. It was found that the leaves contained very little juice or flesh and the rollers had no appreciable effect. Subsequent attempts to ret the crushed leaves showed promise at first, but the ret then stopped. It is felt that retting might be a possible method for large-scale production, but would probably require a fairly complicated procedure which would make it unsuitable for peasant production. The East African Bag and Cordage made a grant of £300 for the construction of an experimental raspador, which should be ready for trials in January, 1962.

The diablo roller for ridge compaction was tried out at Perkerra, and the results were reasonable. A second roller was therefore constructed with an improved mounting, and the two will be used in extended trials.

Experimental Equipment.—A Sheep-skin roller for harvesting Subterranean Clover was constructed according to pictures of Australian equipment, but trials were delayed due to rain. An experimental lab-sprayer designed to spray "potted" coffee bushes 2 ft. to 4 ft. high was constructed. The bushes are to be placed on a turntable revolving at 8-15 r.p.m., and sprayed from a single sprayer moving up a vertical column at 2-8 f.p.m. Initially a modified paint spray gun was fitted. The distance between sprayer and turntable is adjustable from 3 ft. to 6 ft. The sprayer has been installed in a special "room" in a green-house at Jacaranda for trials.

A jet or injector pump was designed to cope with coffee parchment, skins or sisal waste, and a 1½-in. diameter model made up. The pump used an annular jet round the venture, and gave a perfectly smooth straight-through pump. Preliminary trials showed it could pump coffee and sisal waste without any difficulty, and if blocked could be cleaned immediately. A start was made on a test rig to determine its efficiency which should be 10-40 per cent.

Design Projects.—Proposals for investigations into the use of water in sisal decorticators, and the subsequent handling of waste and effluent have been submitted to the Sisal Growers. The work on sisal drying has been wound up, and a paper outlining the conclusions drawn up. No further work has been done on the projects carried over from the previous year.

General.—Theoretical work on the mechanization of African agriculture continues, as well as possible simple forms of drier for coffee, pyrethrum and other crops.

Testing of Agriculture Machinery

The East African Testing Unit, based at Nakuru, working in conjunction with the National Institute of Agricultural Engineering in England and liaising with the Tanganyika Agricultural Machinery Testing Unit, Arusha, and Special Developments Section, Namalere, Uganda, continued its work in the three East African territories, but received orders in September to close down before the end of the financial year.

Staff remained at full establishment of 3 Senior Technical Officers, 2 Technical Assistants, 1 Secretary/Stenographer and 5 minor employees.

The Unit's services were fully booked up for the whole year before 1st January, 1961, and due to uncertainty of its future could not accept numerous further test requests.

The year's work was as follows:—

1. *Farm Trials.*—This trial was satisfactorily concluded during the year and gave much useful information not only to the manufacturers and farmers concerned, but also on tractor use in general in East Africa. The five tractors concerned were all farmer-owned, situated one each in Tanganyika and Uganda and the remaining three in different parts of Kenya.

2. *Altitude Investigations.*—The report on the work done last year was published and two further investigations were carried out for manufacturers; one involved not only diesel engine efficiency at various altitudes, but also "cold starts" difficulties, whereas the other was involved with normal running temperatures.

3. *Standard Altitude Tests.*—Five tests were carried out during the year and reports on four have been published.

4. *Fuel Filtration Tests.*—This trial was also completed during the year and all details submitted to the National Institute of Agricultural Engineering.

5. *Drier Tests.*—Three more crop driers were tested during the year. Two were pyrethrum driers and the other a general purpose drier. Reports on all three were published.

6. *Implement Tests.*—One forage harvested was tested but the report was not published. A very satisfactory test was carried out on a British rotary cutter/slasher and the report published. Following the series test of small mechanized cultivators reports were published on three of the five and then further work carried out with three in African areas. At the end of the year tests were still in progress on a transplanter suitable for pyrethrum amongst other crops, two inter-row cultivators and a ridge planter and general purpose toolbar.

7. *Work in African Areas.*—Considerable time was spent on tests and trials of a variety of tools for African use. They included four models of seeders/planters, two two-wheeled tractors with allied equipment and two mechanized cultivators. Also assistance and co-operation was given to those concerned in the trials of the the National Institute of Agricultural Engineering developed ox equipment as well as doing investigations in African areas on ox draught figures and tractor wheel slip.

8. *Tie-ridging Trials.*—Co-operation with the Department of Agriculture, Tanganyika, on the trials of the National Institute of Agricultural Engineering equipment led to work being done in the Arusha area.

9. *Serere Tractor Trials.*—The trials of the four different makes of tractors on the Uganda Government Experimental Station was completed during the year.

10. *Other Work.*—Co-operation with the Tanganyika Pasture Research Organization on the bush clearing trials continued throughout the year.

A limited amount of work done on dust ingress to engine and machines was done for the National Institute of Agricultural Engineering.

A paper was written in conjunction with staff of the Special Developments Section, Department of Agriculture, Uganda, on the results of trials of the modified tractor used in Uganda.

Investigation work was carried out on fertilizer placement by a number of drills, small engine performance and tractor use in African areas.

The Farm Economic Survey Unit

In the four survey districts of the European farming area (Njoro, Trans Nzoia, Uasin Gishu and Molo/Mau Narok) the collections and analysis of farm input and output data was continued on a total of 68 farms. The purpose of analysis is to prepare the figures in such a way that they are available to the individual survey co-operators and to other farmers in the same or similar areas as a basis for the comparative perfomance judgement of all sections of the farm business. The published results, which have a great potential use in advisory work, continue to show that intensive farming is the best way to satisfactory results on all but the very largest mixed farms.

Four reports were published during the year on surveys carried out in the Njoro, Trans Nzioa, Uasin Gishu and Molo/Mau Narok areas, thus making a total of eight reports to date since the work started in 1958.

To gain experience of work in African areas and to obtain some knowledge of the performance of peasant farms of the size likely to be found in peasant settlement areas, small pilot surveys were undertaken in the Nandi and Elgeyo-Marakwet districts. The first year's results are under analysis at the time of writing.

The full analysis of accounts kept on the commodity research stations at Ol Joro Orok, Eldoret and Kitale has become a regular feature of the Unit's work. A common system of account keeping has been laid down and next year the Grassland Research Station, Molo, will be included with the others.

In September, preparatory work began on a scheme to study certain economic aspects of farming in South Nyeri District. One of the Unit's two economists is now stationed in Nyeri and three field assistants have been recruited and trained to assist him in this work. Two major projects are envisaged for 1962:—

(i) A study of the cost of developing to full production those high-investment enterprises for which Government loans are commonly given.

(ii) A detailed study of the labour input involved in the most important crops grown in the district.

It is intended that the results of this work should be of value to planners in many African districts where farming is developing rapidly, both within and outside Central Province.

Plans have been prepared and submitted for the establishment of a further section of the Unit which should be devoted entirely to studying the new farming being sponsored by the Land Development and Settlement Board. It is hoped to recruit a number of field enumerators who would study peasant settlements in different ecological zones and give guidance and advice on systems of accounting suitable for small farmers. By studying the economic position of the land, both before and after settlement, it is hoped to yield information which will be of value both in the assessment of progress of existing cases and in the planning of new settlements.

PART III.—FIELD SERVICES

Progress in Improved Farming

European Areas

In spite of the unsettled political conditions development expenditure increased in respect of platation industries, but in the mixed farming areas this was reduced to the purchase of essentials. Few farmers were prepared to invest in projects which did not give quick return on outlay. It is sad to record that following the spectacular growth in demand for farm planning over the past ten years, the record of achievement could only show 18 farms, totalling 19,925 acres having been planned in 1961. The advisory services of the Department have, however, been very fully occupied with the accent on requests for advice on the adaptation of farming systems to meet current conditions and quick return projects on the farm.

Resettlement

Acting in an advisory capacity to the Land Development and Settlement Board, the Agricultural Department carried out numerous surveys in the Scheduled Areas and advised the Board on such matters as the economic capacity, size of holdings and farming systems to be adopted in the proposed settlement areas.

Development Loans

The Board of Agriculture (Scheduled Areas) approved development loans totalling £262,550 in 1961. These loans, which are administered by the Board, were mainly for stock, water development and machinery, i.e. cattle £115,131, sheep £21,030, water £35,674, machinery £59,483. The amount of loan moneys issued to farmers in the Scheduled Areas now totals £1,415,584.

Asian Areas

These areas are mainly concerned with the growing of sugar cane and improved standards of cultivation are being practised on several estates in Nyanza Province. In Coast Province a number of Asian farmers are prepared to develop their land, but there are no facilities in the province for them to obtain credit.

Production from Kenya sugar factories was 10.1 per cent above the 1960 figure. A new development in the sugar industry of East Africa was the introduction of the first sugar refinery by Miwani Sugar Mills which was installed in 1961 at a cost of £180,000. Although not yet in production, this plant will shortly be producing refined sugar in bulk, as well as small packs of refined, cube and icing sugar. This will mean that Kenya's canning industry, as well as the other manufacturers will, for the first time, be able to obtain refined sugar produced in the Colony.

African Areas

In general, the position with regard to progress in improved farming in African areas is that certain districts are going ahead fast, others are at a standstill, and some are actually deteriorating.

The most progressive districts are Kiambu, Elgeyo, Nyeri, Embu, Meru, Nandi, Kipsigis, West Suk, Baringo, Kisii, Elgon and North Nyanza. No other district is making significant progress towards better farming, though many of them are increasing their cash income derived from certain crops, such as coffee.

Machakos, Kitui and Central Nyanza may be singled out as districts in which actual deterioration of the standards of farming have taken place; while Fort Hall has been held up in its development through delays and errors in consolidation which are now being rectified. In Coast Province there is still hardly one good farm to be seen, with the possible exception of a few in the Taita District and at the Shimba Hills settlement, where African agriculture is organized. Coast Province is one part of the country which epitomizes the increase in incomes derived from extra cash crop production, without any real improvement in the general standard of farming.

If farm layouts are used as a yardstick of progress, the area under sound management in some districts has increased. Taking the Colony as a whole, 10,644 new layouts were completed during the year, bringing the total of farm layouts and farm plans to date to 35,260. These layouts are supported by at least reasonably adequate loan funds for development and the amount of money out on loan in all African areas was £391,347 at the end of 1961 from Government sources, and £300,000 from banks. It is thus true to say that there are at least 30,000 farmers in all African districts of Kenya, but principally in Central Province, Elgeyo and one or two other progressive districts, who have got the facilities available for a rapid increase in their standards of living. This figure is, of course, not nearly high enough but it is a very substantial advance on the position five years ago, and no one is in any doubt that given adequate staff and facilities it could be rapidly increased.

Staff in districts are fully extended in the work that they have to do, and one of the principal bottlenecks is in the shortage of Field Assistant Instructor staff who are in direct contact with the farmer. The present layout programme, if 100 per cent efficient, would represent about 4 per cent of the potential African farmers and since about 50 per cent of the layouts are abandoned by the recipients without being acted upon, the actual figure is more like 2 per cent of the total potential. Even this small body of progressive individuals requires so much personal attention from Agricultural Officers, Assistant Agricultural Officers and Field Assistants that nothing very much in the way of extra commitments can be accepted with the present staff strength.

Many farmers have, of course, developed their holdings on reasonably sound lines without a formal layout and often without a loan. Farmers in this category include the majority of the inhabitants of Kericho District and many of the farmers in Elgeyo who enclosed their land and divided it up into fields a good many years ago. Field divisions are very often on a contour and the standard of farming achieved was at least sound, if not what might be called optimum for the district concerned. It is probable that over the past decade something like 1,000 square miles has been enclosed and partly developed in this way. However, development seems to have stopped to a very large extent at that point. These farmers still cultivate maize, or other food crops in a somewhat primitive manner and they still, in general, graze unimproved stock on their holdings. The maintenance of hedges in Kericho District has in recent years deteriorated and it is in general very difficult to get these farmers to move beyond their present achievements. Even including these partly developed farms in the area which are regarded as being under sound farming or beneficial land use, it would be over-optimistic to say that more than 10 per cent of the African high potential land is soundly farmed at the present time. This is of course a considerable advance on about ten years ago when the figure was more like 2 per cent.

Some of the land which was formerly regarded as being soundly farmed under beneficial occupation has in fact deteriorated in the last two to three years. This includes some of the formerly well maintained acreage of coffee in African

areas. The main reason for this is shortage of staff. Government cannot afford to provide enough staff for these areas and has had to pass some of the responsibility to the industry, which is so far not very willing to accept it. In addition there has been an enormously accelerated programme of coffee planting in most districts. The result of all these factors is that the attention paid to some individual holdings of coffee in many of the more progressive and expanding districts has greatly deteriorated. Pruning, mulching, fertilizing, spraying against diseases and pests and other desirable cultural practices have not been attended to with the same care as previously on many holdings with the result that these farmers have obtained lower yields of poorer quality coffee.

Nyanza Province.—Land consolidation, enclosure, and planning has again been most successful in the North and Central districts and this can, to a very large extent, be attributed to training courses at Farmers' Training Centres, which are giving the initial urge to farm better. This applies to all districts. In South Nyanza is it reported that an encouraging number of farmers are making a genuine attempt at improvement. Efforts are being made to educate the farmer to improve his land by concentration on a large number of people from a restricted area, so that it quickly becomes "socially acceptable to follow the new practice". Tours to other parts of the Colony have assisted in the achievements made.

There has also been a widening range of cash crops and cotton, groundnuts, capsicums, garlic and pyrethrum are becoming popular in those areas where they can be grown.

The voluntary "exchange" of land to consolidate holdings has gone ahead by leaps and bounds and exchange groups are spreading to all areas. Enclosure has always been the main bottleneck between exchange and farm layout due to—

(*a*) insufficient hedging materials; and

(*b*) inadequate staff to do the follow-up work.

Newly formed Administration demarcation teams have been started and with these it is hoped to ensure that both consolidation and enclosure go ahead at an equal pace.

Some improved stock have been introduced, but the general standard of stock management remains lamentably low.

It is fairly obvious that the impact of consolidation, the introduction of cash crops, and the advice and training at Farmer's Training Centres have played an all important part in the general desire of the people to endeavour to improve not only their farming systems, but to get more from the land and to approach agriculture in a more progressive and co-operative spirit. This material desire in an ever expanding economy reflects the many years of patient endeavour of the staff of the Department.

Rift Valley Province.—In West Suk progress has been made in farm planning with the resultant improvement in agricultural practice, and in the Baringo district there are now 161 planned farms. In the Elgeyo/Marakwet district enclosure has forged ahead and the standard of fencing with cedar posts and wire is encouraging. In the area, 117 farms were laid out and planned during the year, this total excludes the many farms which have been contour fenced and planned by the owners with the minimum assistance from this Department. It is a great credit to the farmers themselves that improved farming should be so widely accepted in this area.

In Nandi the farm assessment scheme helped greatly in focussing the attention of all Departments on overall improvements. The greatest improvements and progress have been made on individual holdings where the introduction of better cattle, tea, coffee, or pyrethrum has set the farmer on the way to better things.

Central Province.—Both Kiambu and Nyeri districts are fully consolidated and Embu is expected to be completed by early 1962. Meru, on the other hand, is progressing slowly. In Fort Hall, considerable agitation necessitated the re-opening of the Land Registers and the whole district had to be dealt with again. By the end of 1961 much progress had been made in land consolidation, and this re-assessment of the original consolidated areas has resulted in much more contented land owners, which in consequent has encouraged improved farming of a higher standard than has been noticeable for several years.

Farm planning has made steady progress in most districts. There are signs of the widespread use of artificial fertilizers, fungicides and insecticides on crops other than coffee. This is largely attributed to the teaching at Farmers' Training Centres and to the interest of commercial firms. It has also been aided by the high price of Masai *boma* manure which now costs Sh. 40 per ton. An African enterprise has been started in a Kiambu village which caters for farmers' needs and a wide range of agricultural necessities. In six months in a restricted locality this concern sold 50 tons of double superphosphate. In Nyeri three business concerns sold £9,000 worth of fertilizer, insecticides and fungicides, whilst the coffee societies in the same district sold £2,000 worth of fertilizers. In 1961, 1,000 tons of fertilizer were used.

The Kiambu African District Council tractor scheme was so successful that two commercial tractor agents each agreed to donate further tractors and equipment. The trained drivers made arrangements to pay off the African District Council loans and have now started work as private contractors. The Embu A.D.C. has also agreed to support a similar Tractor Driver Training Scheme in 1962.

The Channel Island breeds of cattle continued to be popular but there is now a tendency to go for Ayrshires. In the two most advanced districts a good proportion of other popular breeds are represented. The follwing is an estimate of the total grade stock in the Province:—

Breed	Embu	Nyeri	Kiambu	Meru	Fort Hall	Total
Guernsey	1,145	7,000	1,240	652	2,700	12,737
Jersey	—	1,000	452	46	—	1,498
Ayrshire	57	—	1,034	—	200	1,291
Sahiwals and Indian Breeds	455	—	—	—	—	455
Friesian..	—	—	102	—	—	102
Red Poll	—	—	60	—	—	60
Mixed Grade Cows ..	—	12,000	—	—	3,100	15,100
	1,657	20,000	2,888	698	6,000	31,243

Southern Province.—In the Masai districts of Kajiado and Narok the demand for enclosure and dividual demarcation continues to grow. During 1961, the Land Registration Ordinance was applied to Kajiado with a view to encouraging progress in consolidation and individual ownership in the agricultural areas. Starting from scratch, with no problems of fragmentation, an opportunity exists for

skeletal planning of large areas, in proper land use such as has been achieved with such success in Elgeyo. The task is formidable and will require aerial surveys, as it would be impossible to attempt this on the ground alone.

Where the land is not suitable for agricultural smallholdings the Masai are showing an interest in individual ranches. It is too early to say how this new departure will go, but there are few difficult technical problems and the success of the ranches will depend upon the keenness of the Masai and their readiness to accept a radical alteration in their way of life.

Interest in the development of cash crops such as pyrethrum in Narok and coffee in Kajiado has increased among the Masai. They have been badly affected by the drought and later the floods and their desire to improve their agricultural methods is genuine at present. It is therefore essential to provide now for agricultural education and extension to achieve progress in improved farming.

At Ngong, the 20 new farms in the Kiboko area are being fenced. Seventeen applications for loans for this work were made and work had been completed on 15 of these by the end of the year.

In the Kitui district improved farming has continued to progress slowly and there is a general desire to use manure on the land. In some cases fertilizers are popular. Far greater efforts are, however, required by the farmers themselves in the development of their own holdings and towards communal development, especially for such things as water supplies.

It is estimated that in Machakos District only some 10 per cent of the farmers have made any progress towards stock improvement. There is often complete neglect of proper managment of grazing as a result of overstocking. Although there has been an increase in the number of stock exported the stock population of Machakos shows a net increase. During the drought large-scale poaching of schemes and ranches on the B.2 Yatta and at Emali took place by Machakos cattle.

Coast Province.—There has been only a gradual improvement during 1961, and most of the progress achieved has been due to the development of cash crops. In the Kwale District there is a steady and satisfactory trend towards simple farm layouts and general improvements in farming standards. The general apathy of the farmers in this Province is a difficult problem and requires continued propaganda. It was unfortunate that the drought in the early part of the year caused several of the Kilifi District planned farms to get into difficulties. Even so, clean weeding, row cropping and forward planning is gaining ground, and some excellent work has been done with the establishment of deep litter poultry keeping.

In the Taita District it is unfortunate that there has been less evidence of progress. The use of fertilizers has been encouraging, but it is generally agreed that progress is hampered because of the effects of the drought, lack of cash, and uncertainty of what the future holds. The Taita are more cash conscious than the rest of the Province, and it is certain that any real progress will be through cash crops.

The Taita now frankly admit that they lost their chance to consolidate and plan their land fully in 1957, when they were misled into believing that the service was an excuse for Europeans to seize some of their land. Fertilizers have been widely used throughout the Province, and where cattle are kept the use of manure is understood and accepted.

The Coast suffered drought conditions followed by extensive flooding and these conditions have been partly responsible for the slower progress in much of this Province. There is, however, a tendency towards tree crop development and to permanent settlement.

Contract ploughing has featured successfully in some areas, and bush schools have again provided a useful medium to illustrate improved methods.

Statistics of improved farming are given below:—

	No. of farms 1961	*Acreage 1961*
ENCLOSURE		
Nyanza Province	11,633	111,603
Central Province	—	—
Rift Valley Province	341	10,093
Southern	3,221	81,841
Coast	—	—
LAND CONSOLIDATION		
Nyanza	24,184	242,505
Central	—	—
Rift Valley Province	—	—
Southern	—	—
Coast	19	131
DEMARCATION OF FARMS		
Nyanza	4,965	55,863
Central	173,826	863,899
Rift Valley Province	515	30,153
Southern	69	4,373
Coast	612	15,667.69
FARM LAYOUTS		
Nyanza	2,018	18,952
Central	21,835	66,152.29
Rift Valley Province	59	1,770
Southern	152	8,700
Coast	—	—
FARM PLANS		
Nyanza	1	10
Central	2,062	22,071.31
Rift Valley Province	299	9,351
Southern	24	2,360
Coast	76	1,045.89

Reconditioning, Resettlement and Development Schemes

NYANZA PROVINCE

With few exceptions the standard of agriculture remained at subsistence level only. It is however hoped that with the "plant more cotton" campaign this will have the effect of improving standards in 1962. It is also unfortunate that the area is reported to have a high incidence of sleeping sickness, which will inevitably make it still more unpopular.

Kimulot.—This settlement is administered as part of Kericho district. The settlement rules have been cancelled, but plot holders have not been issued with titles as registration was not being pursued elsewhere in the district. Agricultural development continues slowly. The mainstay of the economy is tea, either on the settlers' own plots, in the nursery, or as paid employees on neighbouring estates. Heavy rain did a lot of damage to roads and tracks on the scheme area, but the essential tea outlet road linking the African Highlands Kimulot estate and the smallholdings was being started at the end of the year.

Itembe.—This scheme was included in the Bomet division of Kericho district in February, 1961. The adverse weather culminating in waterlogging on the soils of impeded drainage gave the farmers a poor year. The Cream Schemes were kept going and it is hoped that production will improve with the weather.

Isherere.—The settlement scheme is now virtually absorbed into the general everyday life of the North Nyanza district. Agricultural staff make periodic visits to observe progress and offer advice.

Lusavi-Savi Valley.—Work in the scheme has gone ahead extremely well in spite of the fact that during the year the number of detainees working on the scheme was considerably reduced. Work continues on constructing cut-off drains and stone walls. Runways and subsidiary terraces have been built and the soil conservation work is nearing completion.

The area has been divided into five-seven acre smallholdings and these have been enclosed with a fence. Communicating roads have been made to all holdings and a map of the area has been produced which will greatly assist with further planning. On the Varatzi Scheme is is reported that recruiting for the scheme is slow due to the poor attendance at *barazas.* Sisal is still being planted in the badly eroded areas together with trees and grass for coverage.

Sakwa.—Progress this year has been slow mainly due to the shortage of detainees who are used for bush-clearing. The two-mile wide tsetse barrier has not yet been completed. Cultivation in the cleared area is being encouraged. Some small dams have been constructed in the bushy country, which it is hoped will be an incentive to further settlement in the area.

CENTRAL PROVINCE

Meru Settlement Schemes.—In the Kimbo/Kibirichia settlement area some losses of stock are reported mainly attributed to inadequate spraying facilities. There has also been some loss of income due to poor cultural practice. The scheme is however popular and the losses have served to bring home to the settlers the necessity for proper management. The Pyrethrum Society formed in 1960 operated satisfactorily during the year and is now selling direct to the Pyrethrum Board. Areas originally retained for work oxen grazing are now being allocated as eight-acre holdings.

In the Kirua area progress has been slow due to political agitation and the limitations of the Agricultural and Veterinary Committee.

On the Naari scheme, steady progress has been made. There is a growing demand for pyrethrum, and coffee has been extended in both Ruiri and Nchoroiboro and greater interest shown. At Mutonti, loan advances have encouraged the development of some very well managed holdings on this scheme.

At Giaki and Gaitu settlement the African District Council has passed the necessary tsetse control by-laws under which bush clearing can be enforced and, as a result, regenerated bush has now been cleared.

At Nkuene renewed interst has resulted from the stimulus given by an active Assistant Agricultural Officer. The Farmers' Training Centre has also greatly improved the interest of the local people and steady progress is being made.

At Nyambeni settlement a further 350 acres of tea has been well established. The settlement is progressing towards steady development. This however received a temporary setback during the heavy rains and floods at the end of the year.

Southern Province

Grazing schemes completely broke down during the year, due to gross overstocking and the non-payment of fees. The last vestige of grazing control broke down in February, since when hordes of cattle have been grazing illegally. The Yatta canal has been maintained with grant funds from ALDEV. Trespass by Machakos cattle on the B.2 Yatta Grazing Scheme became evident early in 1961, and in spite of fines totalling Sh. 2,250 having been imposed as a result of 17 court cases, by August there were over 20,000 head of cattle illegally grazing the area. This was further aggravated by several thousand cattle from Kitui area, on the eastern borders of the scheme, illegally grazing. The result—a breakdown in grazing control and devastation over the whole area. Outstanding payments of fees totalled £2,700. During the year, four Sahiwal bulls were stolen from the B.2 Yatta Grazing Scheme and only one has since been recovered. Although political leaders had discussions and undertook to see that illegal graziers would be removed from the B.2 Yatta scheme there has been no improvement and large numbers of illegal cattle still remain.

The Athi-Tiva Grazing Scheme received a financial fillip this year when the African District Council rented the grazing to European farmers for 5,000 head of cattle at a fee of Sh. 2 per head per month. The Ikanga location inhabitants were permitted to move 2,000 head of cattle onto the scheme at a fee of Sh. 5 per head for the year. The European farmers, who had suffered much from drought and army worm on their own farms, at their own expense constructed a spray race and extended the water supplies from the Kamutei tank.

The Simba Emali ranch was retained after difficult negotiations with the African District Council who were seeking to annex the scheme to the adjacent reserve. Since then trespass and poaching of grazing from nearby locations has devastated the grazing, and has made it impossible to carry out a satisfactory burning policy on areas recently cleared from tsetse bush. The ranch stock were sold and no further buying could be undertaken.

The Makueni settlement suffered from over-grazing and although stock sales were arranged these were not successful. The branding campaign was also a failure in that the local people refused to have their stock branded. Attempts were made to burn the tsetse barrier, but due to over-grazing the burn was not a success. This settlement which cost so much money is fast reverting to an overgrazed and eroding area of shifting cultivation.

Kitui Afforestation Scheme.—New plantings included 31 acres of soft woods and 30 acres of hard woods. Considerable damage occurred during the year. 591 acres were destroyed, 31½ miles of fire breaks were cut.

Coast Province

Gede Settlement Scheme.—In 1961 development went ahead at a rapid pace for the Coast. By the end of 1961, 448 applications had been received for new holdings, 164 new holdings had been demarcated and 123 allocated. The total number of settlers is now 712. A new piped water supply from Ganda borehole was almost completed at a cost of £13,000. Political agitation diminished and relationships were more satisfactory.

Shimba Hills.—The settlement scheme has developed rapidly and is fast becoming a success. In 1960 and in preceding years the scheme was not viewed with much enthusiasm. In 1961, however, by October it was necessary to call a halt as settlers were arriving faster than holdings could be laid out or demarcated. At the end of 1960 there were 213 settlers, and at the end of 1961 the number had risen to 617—an increase of 404. The popularity of the scheme can be attributed to:— the success in controlling malaria, the famine and drought in Ukamba, the good results obtained by the earlier settlers, and the relaxation of some of the cultivation rules (though not those connected with essential agricultural practices).

Twenty-eight Wataita entered the scheme from the drought area at the foot of the Taita Hills. Wataita had previously refused to go to the scheme, although they had priority in allocation of places from the start. The Wakamba who arrived were suffering from malnutrition and as a result of this their basic rations had to be supplemented with protein. This increased the cost of rations by £16 per family. The large increase in settlers has brought with it problems of education and provision of medical facilities.

Sugar, cassava, chillies, coconuts and cashew nuts were the main crops grown. An artificial insemination scheme was started using semen from Sahiwal bulls.

Vigurungani Grazing Scheme.—The I.C.A. (now A.I.D.) Range Management Officer continued to advise on the control of this scheme and the records begun in 1960 were maintained during the year. At the end of the year there was some hope of a co-operative attitude from local stockmen in this area generally.

Kilifi Crown Land Development Scheme.—This scheme, designed mainly to legalize squatting on Crown land, is not really a settlement scheme in the true sense; traces are cut and plots of 12 acres are demarcated. These are then offered on a temporary occupation basis with the intention that after five years beneficial occupation the farmers will be able to have a 99-year lease. To date all plots in Block "A" suitable for cultivation (131) have been taken up, but so far very few of the licencees have moved on to their plots. However it is hoped that they will do so for the long rains planting in 1962. Sweet water in the area is marginal Nine boreholes have been sunk, of which eight contain sweet water, but some of these might well become brackish in the dry season. Block "B" of approximately 400 plots is now being developed.

Kishushe Grazing Scheme—Taita District (Western Foothills).—This scheme is designed to help relieve pressure on the overstocked Taita foothills. An additional area of grazing, mainly Crown land, will be made available by the provision of water from the Werugha Dam in the Taita Hills. Funds are available, but work has been held up due to difficulties in tunnelling through the rock saddle, and the lack of suitable piping in the country. The area will provide additional grazing for some 2,400 stock units at a cost of some £16,000, a fee of Sh. 10 per year per stock unit being charged. The local tribesmen have stated their willingness to control and limit stock numbers and to pay fees.

Chala Grazing Scheme.—This is under control of the Veterinary Department, a Livestock Officer being posted to Taveta early in the year. Plans for rotational grazing are being drawn up by the A.I.D. Pasture Research Officer. Progress was made in demarcation and branding, but the area tends to be overgrazed and the scheme as a whole is probably overstocked. The Livestock Officer has a very difficult task because stock owners will not use the northern area due to fear of Masai stock thefts.

RIFT VALLEY PROVINCE

West Pokot (West Suk).—The grazing scheme continued to operate smoothly, among the few in Kenya which did. It was not, however, possible to extend grazing control to any new areas in 1961. The drought necessitated modification of the rotation in April, but as soon as conditions improved the cattle were returned to the correct blocks. The exceptional rains have improved grass cover on all schemes. A stock census combined with rinderpest inoculation was carried out on all schemes during the year.

Baringo.—The many schemes being run in Baringo district fall into three classes. (1) Settlement schemes on high potential land; (2) settlement cum/ranching schemes on land of moderate potential 35-25 in. rainfall; (3) pure ranching schemes on land of low potential.

(1) Settlement on High Potential Land: Lembus Forest.—In the Torongo area 305 farms have been allocated out of 411 available. In Porov-Sinonin, 28 farmers have been settled. In the Lembus Forest it is hoped to open up settlement on all areas allocated for it which at present are:—

Sigoro	2,200 acres
Torongo	11,147 acres
Sinonin	8,360 acres
Tinet	900 acres
Total	22,607 acres

Of this 1,209 acres in Torongo will be location forest and the 900 acres in Tinet are of doubtful value for settlement. This would leave 20,498 acres capable of agricultural settlement.

(2) Individual Holdings settlements on moderate quality land.—The present position is as follows:—

	Acres	Farmers	Stock Units	
Saos	5,000	128	732	Average holding size 67 acres with 10 stock units at 1/10 acres.
Rosaga	3,200	64	407	
Ngubreti	4,412	75	374	
Kiprota	6,069	145	687	
Kisokon I	12,489	136	860	
Kisokon II	2,200	13	385	
Kiptuim	14,147	233	1,946	
Kabimoi	9,000	93	1,023	
Chemogoch	7,900	80	790	
Mugerin—Mukiyuni	8,800	187	676	
Kisanana	8,000	89	648	
Ngendelal	13,178	177	800	
	94,935	1,420	9,238	

These schemes are all in various stages of development towards the ultimate aim of balanced agricultural holdings with the emphasis on stock production, with registration and title. They vary from the very sketchy stage to the fairly well

developed stage; none are producing at optimum or near-optimum, but together, when developed, they should in many cases result in an advance in management practices over a large area. Some of them, e.g. Kiptuim, have been split into individual holdings from the basis of a controlled communal grazing scheme; the doubtful wisdom of this step is recognized but it has been agreed to in response to a strong demand from Administration and people. Others are being developed in formerly overgrazed and eroded areas of the African land unit, and these can hardly fail to result in something better than the status quo.

The oldest established scheme is Kisokon II: progress here is good. All 13 farmers have loans, 9 of the farms have wire fences and there are 124 head of improved cattle. Registration here is being held up to coincide with the larger Kisokon I scheme. Registration is complete on Chemogoch, and farming progress is slow but satisfactory: 61 of the 80 farms here have layouts, 21 farmers have loans and 15 farms are fenced; there are 75 head of improved stock. Registration is also complete at Kabimoi and satisfactory progress has been made here too; 30 farms are now fenced, with 70 head of grade stock, 23 acres of Rhodes grass leys, 21 loans, 7 farm plans, 6 layouts; 9 tractors operate on the scheme and it is hoped that there will be an increase in grass leys and in coffee planting in 1962.

Registration is also complete on Saos, where there is a nucleus of good farmers, and Ngubreti. Demarcation of holdings has been completed in Rosaga, Kiprota, Kisokon and Kiptuim. The other schemes are still in their infancy and at Mugerin and Ngendelal the owners of holdings were unable to maintain fences against trespassing stock from neighbouring grazing schemes; certain areas also suffered from flooding owing to the exceptional rains. All these schemes together, however, should in time result in registration and sound agricultural development on almost all the better land on South Baringo, formerly over-grazed, eroded and a disastrous liability to the country.

(3) Pure Ranching Schemes on poor quality land:—

	Area	Graziers	Stock Units	
Perkerra	16,750	333	1,333	Perkerra Catchment Schemes.
Cheberen	19,000	351	1,200	
Radad	25,000	211	1,250	
Rimose	16,200	208	1,157	Formerly Gobat North.
Gobat	16,800	267	1,680	Formerly Gobat South.
Mugerin	17,325	249	1,175	
Molo Sirwe	10,000	103	532	
Kisanana	5,000	31	240	
Ol Kokwe	9,500	144	658	
Kerio	30,000	944	2,992	
	165,575	2,841	12,217	

Average stock holding/grazier = 4.3 grazing on 58 acres @ 13.5/SU, which may well still represent excessive stocking in these areas.

Management on these schemes during the year has been difficult owing to a combination of drought and flood, but has at least not broken down. Obstruction from graziers has been experienced in Kerio, and poaching of closed areas took

place in Ol Kokwe, Mugerin and Molo Sirwe. In Gobat the graziers saw no point in moving as a result of improvement in grass cover following heavy rains. While grass cover gradually has improved, in some low-lying areas the best grazing has been destroyed, temporarily perhaps, by flooding. In many of the schemes overgrazing has gone so far that many years of favourable conditions would be needed before they can recover completely, while some are so badly infested, with bush that they can probably never recover on an economic basis.

Several other schemes, Ol Arabel, Churo, Saimo and Chapchap are in process of survey and examination, while there are large areas of grazing land as yet untouched. The appallingly eroded Baringo district is attempting to integrate all these schemes into a working whole by degrees, coupled with settlement outside the district and the Perkerra irrigation scheme.

Nakuru District: *Olengurone*.—Over 300 families have now been settled and there remain over 500 still to be dealt with. The Nakuru S.C.S. did further work during the year building tracks in conjunction with skeletal planning.

The pyrethrum acreage increased from 50 to 240 acres during the year, an encouraging sign in a formerly unprogressive settlement. Vegetables and potatoes are being encouraged as alternative crops and are catching on slowly. The future of tea, and of productive livestock, remains problematical in this area, which is probably too high and cold for really productive agriculture.

Soil and Water Conservation

Due to the continuous political uncertainty the demand for the advisory and mechanical services of the Soil Conservation Service fell in 1961. This, combined with heavy rains during the last three months of the year curtailed the amount of work carried out. Apart from the Rift Valley Province, tractors and machinery operated in Nyanza and Coast Province and the Nairobi districts. The future of the service would appear to lie with the resettlement schemes and in the African areas, unless reasonable political stability is achieved.

Soil Conservation—European Areas

District terracing figures are given below and further figures are given in the table overleaf.

District	1941/1958	1959	1960	1961	Total
Trans Nzoia	65,716	1,384	2,466	1,079	70,645
Uasin Gishu	86,016‡	12,568	15,133	4,070†	117,767
Nakuru	72,358	2,991*	1,911	903	78,163
Ol Joro Orok	59,621	5,028	1,824	877	67,350
South Kinangop ..	24,124	5,280	2,887	955	33,246
Nyanza	11,211	234	597	871	12,913
Nairobi	6,615	185	204	198	7,201
	325,661	27,670	25,002	8,953	387,285

* Includes 357 acres in Baringo.

† Includes 11,900 acres in Nandi and Kaimosi.

‡ Includes 12.500 acres in Elgeyo and Nandi.

Permanent Crops.—Work on tea, coffee and sisal estates in the Nyanza and Nairobi plantation areas continued. The acreage known to be protected by various soil conservation methods is given in the table below:—

SOIL CONSERVATION IN PERMANENT CROPS (ACRES)

	Up to 1960	1961	Total
Sisal	14,519	1,200	15,719
Tea	6,578	675	7,253
Coffee	2,730	44	2,774
TOTAL ..	23,827	1,919	25,746

This figure is the known area of soil conservation in permanent crops; however much work of this nature is now carried out privately and the acreage is probably well in excess of the figures shown.

Farm Planning.—The demand for this service fell sharply in 1961. Particulars are given below:—

FARM PLANNING, 1961

District	Farms Surveyed and Mapped		Farms Planned		Total Planned 1951–1961
	No.	*Acres*	*No.*	*Acres*	
Trans Nzoia	15	13,035	13	12,484	74,507
Uasin Gishu	5	5,714	1	606	91,067
Nakuru	4	2,764	1	1,309	101,865
Ol Joro Orok	9	8,201	3	5,526	72,245
South Kinangop	4	4,700	—	—	—
Nyanza	3	3,165	—	—	6,345
Nairobi	—	—	—	—	11,493
	40	37,579	18	19,925	357,522

SOIL CONSERVATION SERVICE

(Output of Terracing, etc., for the year 1961)

District	No. of Farms Treated by Tractor	ACREAGE PROTECTED BY				Total
		Broad Base and "V" Terraces	Diversion Ditches	Narrow Base Terraces	Bench Terraces	
Trans Nzoia ..	49	324	755	—	—	1,079
Uasin Gishu ..	71	1,508	2,562	—	—	4,070
Nakuru	21	35	868	—	—	903
Ol Joro Orok ..	23	—	757	120	—	877
South Kinangop	20	200	755	—	—	955
Nairobi	25	179	—	2	17	198
	209	2,246	5,697	122	17	8,082

The Uasin Gishu figures also cover the Lumbwa area and 220 acres were protected in that area by "V" terraces. In addition, 419 acres were protected by "V" terraces using estate tractors in the Lumbwa area.

COMPLEMENTARY WORKS, 1961

District	Roads	Excavation	Training Banks	Outlet Drains	Cut off Drains
	yds.	*cu. yds.*	*yds.*	*yds.*	*yds.*
Trans Nzoia	35,900	1,300	2,650	25,696	21,022
Uasin Gishu	46,434	125,330	200	26,226	4,587
Nakuru	143,838	—	1,330	7,340	24,150
Ol Joro Orok	21,296	1,978	470	5,257	20,467
South Kinangop ..	79,000	27,650	5,000	1,170	800
Nairobi	5,019	12,990	—	7,417	445
	331,487	169,248	9,650	73,106	71,471

The Uasin Gishu figures include miscellaneous work carried out in the Lumbwa area.

Land Preservation Orders.—The Director of Agriculture issued 25 orders under the Agriculture Ordinance, of which seven were to remove previous orders from the register, seven to require cessation of cultivation in prescribed areas and ten orders were removed from the register for conversion of title. One order was issued for a drainage way to be constructed with ditches and grass planting clauses. In the Nairobi district, river scouts were responsible for 715 acres of terracing.

SOIL AND WATER CONSERVATION—AFRICAN AREAS

Nyanza Province.—The District Agricultural Officer, Central Nyanza, reported that in areas where self-help groups were active, there was a renewed interest in soil conservation; these groups undertaking the repairs of old terraces and also the building of stone walls on the steeper slopes. In other areas prosecutions were the only effective means of stimulating interest in soil conservation. Communal turn-outs on soil conservation no longer exists in North Nyanza. Some work was carried out by individuals on their own holdings. In Elgon Nyanza soil conservation is not a great problem, except where new land is opened when grass strips are apt to be forgotten. In Kisii, through wilful misunderstandings of the findings of the Swamp Committee, there was an increased cultivation on permanent swamps during the year. The floods ruined the crops and control will be regained in the new year. Generally, conservation measures remain satisfactory.

There has been a definite appreciation of the need for water conservation in all areas and it is hoped that most districts will have a proper organization for dealing with the construction and maintenance of installations in the coming year.

Rift Valley Province: General.—The development of water supplies has continued in all districts and during the year the Lallaringet piped scheme in Nandi was opened. This scheme provides individual supply to 200 farms. Further development of roads on a skeletal planning basis took place at Olengurone and layout of holdings in the Lembus forest excision has proceeded. The heavy rains at the end of the year caused serious erosion in many areas and damage to irrigation systems, drains and water supplies.

Central Province.—Whilst the considerable cover by standard soil conservation works achieved before, during and immediately after the Emergency has deteriorated, or has been badly maintained, improved farming is taking its place

slowly. In many districts there is a better balance of the grass/arable ratio, organic manure has both raised fertility and lowered erodability, improved management of cash crops such as coffee on benches, mulching, the correct spacing of pineapples planted on the contour, bananas in pits, have all added their anti-erosion quota. This is a desirable trend as the exceptionally heavy work which the old terracing systems entailed must give place to something else and what could be better than straightforward improved farming.

The record heavy rains caused extensive damage; one of the most notable episodes being the collapse of one side of the Kazita Valley at Meru *boma* during a period in which 56 in. of rain fell in one month.

Although in all areas there has been much scouring of river beds and swamps and in general there has been considerable soil movement, it is remarkable what little damage has occurred in the face of this prolonged and intense period of rainfall at the end of the year.

Fort Hall district has made an excellent effort and adopted the standard soil conservation practices to a marked degree and the following table demonstrates the effective results:—

Year	Terraces Reconditioned	New Terraces	Bench Terraces
	Miles	*Miles*	*Miles*
1961	3,282	1,132	765
1960	1,581	670	361
TOTAL ..	4,863	1,802	1,126

Southern Province.—Devastating drought followed by floods have greatly hampered work in this district. Soil conservation measures have proceeded and their effect was noticed in the heavy rains. Most of the farmers in the district are conservation minded and much effort has been put into this work.

Coast Province.—Overall soil conservation measures stood up to the recent floods and heavy rains. In Taita 524 miles of trash lines were put down. This system is, however, not suitable in all areas of the coast due to termites. Generally, other forms of soil conservation constructed in these areas have stood up well and are being maintained.

WATER CONSERVATION—MECHANICAL DAM CONSTRUCTION UNITS

The work done by the Mechanical Dam Construction Units of the Soil Conservation Service is detailed in the table below:—

Unit	No. of Dam and Water Holes	Earth Moved in Yards	Water Storage	Tractor Hours Worked	Mean Output per Tractor
			Mil. gal.		*hr. cu. yds.*
Trans Nzoia	4	22,000	21·00	301	73·0
Uasin Gishu	100	181,350	22·50	2,298	78·9
Nakuru	10	41,200	17·25	1,246	33·2
Ol Joro Orok	7	34,950	15·53	917	38·1
South Kinangop ..	14	229,000	137·00	4,194	54·5
TOTAL	135	508,500	213·28	8,956	56·8

To the figure of hours worked should be added 564 hours comprised of 508 hours worked by the Nakuru Unit on sewage schemes at Lanet and Molo with pool tournapulls and 56 hours by the Trans Nzoia Unit on a minor water scheme. The total hours worked therefore is 9,520. The South Kinangop Unit includes the South Nyanza sub-unit (9 dams—119,000 cub. yd.) and the Coast sub-unit (2 dams—32,000 cub. yd.).

Water Supplies—African Areas

(*Schemes carried out by the Ministry of Works, ALDEV and the Department of Agriculture*)

Nyanza Province.—During 1961 74 large dams and 249 small dams and tanks were constructed, 24 boreholes put down and improvements made to 4,304 springs and waterholes. Two rams were installed. Generally this is a satisfactory volume of progress and will greatly assist the Nyanza people. There has been a definite awakening to water conservation in all areas, and it is hoped that most districts will soon have a proper organization for dealing with the construction and maintenance of installations.

Rift Valley Province.—One large dam, 104 small dams, 27 boreholes and pump schemes were constructed and 1,169 piped streams and springs were dealt with. In addition 130 domestic water supplies were put in. During the year more dams and waterholes were constructed in the grazing schemes in West Pokot and Baringo. In Nandi the Lolloringet piped scheme was opened, providing individual supplies to 200 farms. The Saos pipeline, which serves 105 farmers on 5,000 acres, was completed during the year.

Central Province.—With the progress of consolidation has followed a demand for assisted schemes and the development of water supplies continues on an increasing scale as planned farming and general development increases the need.

In Nyeri the Zaina Water Scheme was completed at a cost of £17,888 whilst further schemes were put up, including the Tetu/Thegenge Scheme and the Ruguru Scheme, the latter estimated to cost £130,000. In Kiambu the African District Council financed Hydrological Survey by the Ministry of Works was concluded and a £1¼ million scheme was drawn up by the Ministry of Works. In Embu the Kabare Water Scheme (£40,000) was commenced, with assistance from the local people.

The Provincial Agricultural Committee take the attitude that these major schemes must be seen to be working, with the loans being repaid, before it can sanction further expensive development of this nature.

Southern Province.—At Ngong work has been started on the Kiboko farms reticulation scheme. In Machakos five dams with estimated capacity of over 1,000,000 gallons and 17 smaller dams have been built. Famine Relief labour has been used on many of these. 52 sub-surface dams have been built during the year, mainly in the locations Wamunyu, Masii, Kibauni, Kisau, Mbooni, Muthutheni. The construction of weirs and wash-stops has continued, notably in Kalama. Three wells were sunk at Kilili and ALDEV installed a pump and pipelines to reticulate water to Campi ya Mawe and Farm S. In the northern area well digging has continued with 124 in Matungulu and 29 in Kangundo. A rock catchmen tank at Makueni of 150,000 gallons was completed and an earth dam for the catchment at Thabu. A small rock catchment has been built at Kibauni. In the Kitui district little or no development took place. The Zombe and Ikutha pipelines were completed.

Coast Province.—Arrangements were made for one of the Soil Conservation Dam Units to work in the Coast Province. Unfortunately, its arrival coincided with heavy rain. However, two very successful dams were built in the Kwale District and roads and cut-offs constructed at Shimba Hills. In the Kilifi District a very big effort was made to put all dams in order. Altogether 13 dams or spillways were repaired or desilted, and three new tank dams constructed as famine relief work. Two dams were destroyed by floods. Four new dams were constructed as famine relief work in the Malindi sub-district, and many others repaired; on the debit side, two were destroyed by floods. The District Agricultural Officer, Taita, reports that no new dams were constructed, but all the old dams stood up to the heavy rains. In the Lamu/Tana River district, two village *jabias* were built, and two dams were built on the stock route at Barigoni and Kitaka. Subsequently, the Barigoni dam washed away, but the Kitaka dam remained intact in spite of having 15 ft. of water over the dam wall.

Irrigation

Irrigation Development Projects: *General.*—The Mwea scheme is fully consolidated and is an economic success. On the Tana River scheme an innovation was the admission of Wapokomo tenants. The Perkerra scheme suffered from a shortage of water in the early part of the year and this was followed by devastating floods which, coupled with some crop losses particularly of onions from disease, made the future of the scheme seem even more precarious.

Mwea Irrigation Scheme

Development.—The occupied acreage of the scheme remained at 5,000, with no extensions during the year. In 1961 the whole acreage of the Scheme was mechanically cultivated for the first time. Mechanical cultivation has greatly assisted in the timing of agricultural operations in the field, this in turn has achieved the desired effect of more rational use of water and improvements in discipline. In retrospect the year has been one of solid achievement. The first full crop was reaped off the developed area and yielded about 150,000 bags of paddy, of which 129,998 passed through the scheme's marketing arrangements, the remainder being used for subsistence.

Settlement.—The total number of tenants is 1,246 of which 587 are at Tebere and 659 at Nguka.

By the end of the year there was a slight increase in the number of Embu tenants, caused by three Kiambu tenants leaving the scheme and their replacements with Embu men and the allocation of two new holdings to Embu. During the year ten holdings changed hands under the succession provision of the Irrigation Rules. In eight cases succession was caused by the death of the tenants and in two cases by the dismissal from the scheme of tenants sentenced to more than six months' imprisonment. Six other tenants were dismissed from the scheme during the year; three of these tenants had their licences terminated because of imprisonment sentences of more than six months, whilst the other three were dismissed for repeated and flagrant breaches of the Irrigation Rules.

Crops.—Statistics of the rice crop both at Tebere and Nguka are summarized as follows:—

	Tebere	*Nguka*	*Total*
Acres Cropped	2,338	2,620	4,958
Total Yield (Bags)	70,515	79,483	149,998
Total Yield (Tons)	5,037	5,677	10,714
Mean Yield (Bags/Acre)	30.16	30.33	30.25
Mean Net Income (Tenant/Sh.) ..	2,676	3,012	2,854

The crop was characterized by the large number of tenants with yields of more than 40 bags per acre. In 1961 a total of 92 tenants fell into this class compared with 11 in 1960. One tenant reaped the record yield of 51.50 bags per acre. In 1961, 200 tenants or 16 per cent of the total failed to reach an income of £100; in 1960, this figure was 24 per cent. At the other end of the scale 43 per cent of the tenants earned more than £150 from their crops compared to 29 per cent in 1960.

Yields in 1961 increased by 5.87 bags per acre. In 1961 each tenant retained for home consumption 14.66 bags of paddy worth Sh. 469.12. The net income therefore can be regarded as profit. The mean cost of production per bag was Sh. 8.44, which amounts to 26 per cent of the total revenue of the product.

The 1961 crop was distinguished for its extremely drawn-out nature. Planting began in August, 1960, and continued right through to January, 1961. Harvesting was similarly a lengthy process which continued from December, 1960, to June, 1961. These difficulties should not recur as the 5,000 acres is now fully developed.

The exceptionally heavy rains in October/November caused considerable anxiety. Little damage was however recorded and only five acres were destroyed by flooding from the Thiba river.

Minor infestations of caterpillars were controlled in the nurseries. Rats caused some damage for a short period in the nurseries at Nguka. Some leaf miner was noticed but was controlled by spraying with D.D.T. Hippopotami caused some damage to the crop growing along the banks of the Thiba river near the mouth of the Nguka swamp.

Experiments and Trials.—On red soil areas, five holdings of three acres each were laid out and three irrigation systems were studied; overhead, level basin, and inclined plane. Each tenant had an acre of food crops—maize and beans; one acre of cash crops—onions, tomatoes or cabbage, and one acre of semi-permanent crops, chillies, bananas or asparagus.

A number of fertilizer trials were laid down by the Research Station on spare fields on the scheme. No significant responses were obtained and treatment effects were rather erratic. No change will therefore be made in the meantime in standard fertilizer recommendations.

Crop Disposal and Mechanization.—The provision of drying floors permitted the crop to be reaped at an earlier date and at a higher moisture content. The increased drying capacity and the policy of early harvesting in 1961 helped to reduce the proportion of the crop arriving at the reception centre below 13½ per cent moisture from 56 per cent in 1960 to 28 per cent in 1961.

The reorganized handling facilities for the crop at both Tebere and Nguka worked exceedingly well. The average daily receipts at both handling centres amounted to 988 bags.

Tenants' reactions to mechanization has ranged from scepticism at the beginning of the operation, through aversion to carrying the portable bridges required for the tractors, to enthusiastic belief in mechanization and requests that it now be extended to the harvest.

Weather conditions ranged from the driest on record to the wettest on record: 64.37 in. of rain, of which 40 in. fell in October/November, as compared to 1960 in which only 23.07 in. were recorded.

PERKERRA IRRIGATION SCHEME

Development.—In a survey carried out in 1961 by the Chief Hydraulic Engineer and his staff, it was estimated that £16,500 was required to bring into use land that had already been prepared, plus 300 acres of land planned but not yet developed for irrigation. With only a small staff available for the scheme, and in view of its doubtful future unless a satisfactory cropping regime can be found, no significant development was undertaken.

Settlement.—The number of tenants in 1961 rose from 99 to 128. Of this total, 29 are trainee tenants working holdings of one acre. There are 104 Tugen and 23 Njemps on this scheme. Eight tenants either left the scheme or were dismissed and five reverted to one-acre holdings to try again. Of the 29 trainee tenants occupying one-acre holdings the best 13 filled the vacant tenancies, the worst nine were discharged and seven were allowed to continue on one-acre holdings. In November, eight tenants were warned under rule 21 of the Irrigation Rules and this had a most salutary effect on the others. There is no doubt that the Njemps tribesman is a poorer farmer than the Tugen, but it is possible that the gap is narrowing. Neither could yet be called skilled or resourceful irrigators.

Crops.—The onion crop suffered tremendous losses in the seedling stage; 1,118 lb. of seed planted up only 62.29 acres. At the transplanting stage the water supply was inadequate and delays were frequent, resulting in some crops being half grown whilst others, sown at the same time, still awaited transplanting. Before reaching maturity, disease (a species of *Botrytis* (Blast)) struck the crop. The harvest was poor both in yield and quality, and poor prices were obtained.

The crop yielded 1,302 lb. of onions per acre which gave a total crop of 81,090 lb. of saleable onions at a gross value of 21 cents per lb.—yielding a net figure to the tenant of 18½ cents per lb. The crop should have yielded some 8,000 lb. per acre at a considerably higher price. The effect on the economics of the scheme was serious.

Taboran maize was issued to one tenant and ripened four weeks earlier than local maize, and yielded 11 bags per agre. This maize was very popular and the tenant was besieged by others wanting seed for planting in the second season. A short-term maize is desirable to allow of more efficient two-season cropping.

The late harvesting of the long rains crop delayed the planting of the short rains crop. Onion seed was sown in September, and planting of maize, beans, and green gram had started when ultimately heavy rain and flooding made cultivation impossible. With the exception of part of December, mechanical cultivation was still impossible at the end of the year. Onion seedling losses in the short rains were again considerable; although 1,272 lb. of seed were sown it is estimated that the crop area will not exceed the earlier planting. Whereas transplanting of the first crop was delayed by drought and lack of water, the second crop was hit by excessive rains and flooding. The second crop has also been affected by *Botrytis* Blast, though possibly less than the first crop.

General.—River flows have been erratic varying from three cusecs to a flood of over 50,000 cusecs. Flash floods with an enormous silt load were common during the unprecedented heavy rains at the end of the year. 14 houses were carried away in one flood and in November a flood undermined the tail of the headworks and carried away about one-third of the weirs as well as a section of stone pitching. At the end of the year the river had still not subsided sufficiently to assess the total damage and loss, but it is certainly large.

TANA IRRIGATION SCHEME

The year started with a decision by the Government to close the scheme down because of lack of funds. Following representations by the local people the Minister for Agriculture visited Galole to assess the scheme's possibilities. The Development Committee later advised that the scheme should continue on a year-to-year basis under the strictest economy, but utilizing all 1,200 acres so far developed for irrigation. As this decision was not reached until mid-February, there was not enough time left for land preparation and recruitment of new tenants. In mid-April 400 acres of cotton were sown and 100 tenants were on the scheme. It was intended to take on 100 further tenants in October, but the flood conditions prevented this. The existing 100 tenants planted 220 acres of maize and 50 acres of beans in the short rains season.

In order to be able to cultivate 1,200 acres in 1962 it was necessary to install a second pontoon and pumping plant. Work on this started in the latter part of 1961, but floods and excessive run-off from the hinterland seriously interfered with it. However it is anticipated that the second pontoon will be installed and working by March, 1962.

Settlement.—This year for the first time restrictees were no longer tenants of the scheme. In the first part of the year most of the original detainees were released. Of these 53 asked to be allowed to stay on as tenants. In March 47 Pokomo tenants were enrolled; these came from three locations nearest to Galole, namely, Malalulu, Zubaki and Ndura.

The most important innovation of the year was the tenancy by the local tribe of riverine people—the Wapokomo. These people proved beyond doubt that they were capable of being good tenants and they cultivated their holdings better than the more experienced Kikuyu. Any future tenants for the 1,200-acre scheme will be drawn from this tribe in the first instance.

Crops.—400 acres of U.K.51 cotton were planted and were sprayed five times during the growing season by an air spraying contractor. Owing to the extraordinarily heavy rain in October/November much cotton was spoiled and the final yield is likely to be in the region of 900 lb. per acre overall. An excellent yield would have been obtained under normal conditions.

Two hundred and thirty-four acres of maize were harvested in February/March, 1961, and average eight bags per acre. 220 acres were planted in the rains of October/November. *Polysora*-resistant maize was again planted for bulking in isolation but the yield was poor. A second crop was planted in October/November.

Forty-three acres of Bombay red onions were planted but as these were consumed locally, yields were not recorded. Quality was mixed and only poor prices were obtained for the onions offered for sale.

Forty acres of groundnuts were sown in the short rains of 1960; these were harvested in March/April and although yields appeared reasonably good, little of the crop was offered for sale.

Dates grew so vigorously that they had to be thinned out; the thinnings were planted on an adjacent area, doubling the size of the plantation. Flowering and fruiting has been erratic and matured fruit has not yet been harvested. The abnormally wet conditions at the end of the year upset the palms quite considerably.

General.—In September, work began on the installation of a second pontoon. It has 2× 10 cusec pumps and when added to the existing pontoon, will double the effective pumping capacity.

In the middle of November, the Laini Donga flooded and not only washed out the canal crossing it, but it also surged back to the head of the canal, and eroded round the stilling box. This 50-ton lump of concrete dropped into a hole 15 ft. deep, and the water than passed on and cut out a 50-ft. wide chasm down to the river. Some of the pipes for the second pumping plant fell into this chasm and some are still missing, though most have been found, buried deep in the sand.

The rainfall was 38.08 in. for the year, of which 11.96 in. fell in September. Heavy rain up-country caused the Tana River to flood in October/November to unprecedented heights, which actually destroyed the Pokomo riverine cultivation.

The only Pokomo who reaped anything substantial from crops in October to December were the scheme's tenants; there is a long waiting list of Pokomo for tenancies on the scheme.

Agricultural Education

While the Farmer's Training Centres continued to provide adult farmer training, a surge of enthusiasm for academic training in vocational and technical agriculture occurred in 1961.

The first B.Sc. graduate from Makerere College joined the Agricultural Department in April. After six months' field experience he proceeded to the U.S.A. on a Kenya training bursary to pursue postgraduate studies in extension methods.

The first diploma course at Siriba was completed in December and in a class of 21, only one failure occurred, although three students were referred in certain subjects. The 17 diplomates were recommended for promotion from the E to C scales to serve as Assistant Aricultural Officers. These diploma students were all Field Assistants of the Department of Agriculture, holding the Kenya Certificate in Agriculture. In addition, 31 students completed a two-year certificate course. Eight obtained passes at the credit level, 16 passed at the ordinary level, five were referred in one subject and two students failed. In October, 25 students entered the two-year diploma course.

The first diploma course for all races began in October at Egerton College, Njoro, and 47 first-year students were accepted for entrance. The first-year students were partly financed by Kenya Development and Training bursaries and partly by "merchants' bursaries". These merchants' bursaries were subscribed by leading Kenya commercial firms and enabled those wishing to follow an agricultural career to do so when Government funds were stretched to the limit for finance to educate and train local residents in all departments of Government. The 47 students comprised 29 Africans, 14 Asians and 4 Europeans.

A promotion course held at the Kenya Institute of Administration resulted in 11 Field Assistants of proved worth and long service being promoted to the Assistant Agricultural Officers' grade. One other was promoted following a course in Israel. Four African Assistant Agricultural Officers returned from postgraduate studies in the U.S.A., and as a result of their attainments were promoted to the A scale as Agricultural Officers, raising the number of African Agricultural Officers in the Department to six. Training courses for officer and instructor grades took place at various institutions within the country and abroad in U.S.A. and Israel. Certificate in agriculture training for the agricultural instructor cadre was intensified at the Agricultural Training School at Embu, and at the beginning

of the year 40 final year students were in training. These represented the last K.A.P.E. standard students to be trained at the centre. The course was completed in March, and all successfully obtained their certificates. Following the decision to raise the entrance qualification to School Certificate, 300 forms of application for interview were sent to candidates who had applied for agricultural training earlier in the year. The response was poor and only 34 students began their training. However, 19 candidates were enrolled by June, giving a total of 53 students. As a result of examinations and interviews in September, 25 students were selected from Embu for diploma training at Siriba College, and three others elected to go to Egerton College, after being successfully interviewed for that institution. The 25 students remaining at Embu continued with the certificate course. In addition to the course, 299 junior grade officers received instruction on 12 courses at the centre. It has been decided that the certificate course will commence in mid-February and end in July of the following year. The first two terms will be mainly practical and during the second term field training will take place on selected African farms. At present, the centre has dormitory facilities for a 100 students, but classrooms and equipment are sufficient for only 75. It is hoped to increase the intake of the centre to a 100 per annum, which means that accommodation for twice that number will be necessary.

Farmers' Training Centres

Rift Valley Province.—Kaimosi Training Centre continued with both the certificate in agriculture and farmers' courses. Sixteen students obtained their certificates in March and 21 remained to complete their second year of training.

Farmers' courses held at the Centre included instruction at the Veterinary Centre at Baraton and 266 farmers, junior departmental staff and community development staff attended nine courses at the Centre.

The establishment of the Chebororwa Livestock Improvement Centre as a Farmers' Training Centre has been a major step forward in Elgeyo district. The courses are shared with the Baringo district and are for women as well as men. Six courses were held during the year for 93 farmers and 36 Elgeyo wives.

Southern Province.—230 farmers and 90 farmers' wives attended agricultural courses at the Kitui Better Living Institute in 1961. In addition, courses were held for headmen, cotton instructors, etc. Courses began in August at Machakos, as building operations at the Centre were only completed in June. Five courses of 24 students per course were held at the Machakos Training Centre, giving a total of 120 students for the year.

Central Province.—The Kaguru Farmers' Training Centre, Meru, was completed in 1961 and a total of 363 men and women including 129 Agricultural and Veterinary staff received courses of training there in 1961. Mr. S. Kathurima, M.L.C., officially opened the Centre during the year.

Embu Farmers' Training Centre was also completed by the middle of the year, and 77 men and women attended courses there.

The Mariira Farmers' Training Centre, Fort Hall, still required much development on the farm. However, eight courses were held there and 139 farmers and teachers received instruction. In addition, 119 junior members of the staff attended refresher and training courses.

The Wambugu Farmers' Training Centre, Nyeri, reduced the length of courses from three weeks to two, and 357 men and 257 women received training at this Centre. Of the total of 614, 51 junior staff received refresher courses.

The Waruhiu Memorial Farm Institute, Githunguri, gave courses to 229 men and women. This included 32 members of junior staff who attended three refresher courses. The Thogoto farm was run down and is now used only for milk produc-

tion. Concentration of effort at Githunguri resulted in the planting of coffee and tea at the new site, plus the stocking of the farm with cattle and sheep. Fencing and building alterations were carried out and the Hon. J. S. Gichuru, M.L.C., opened the newly sited institute in August.

The Shell Company of East Africa Limited has generously assisted, not only at Githunguri, but also at the Meru and Embu Training Centres, in providing funds for buildings. The building, known as "Shell Hall" at the Embu Centre was officially opened by the Hon. J. J. M. Nyagah, M.L.C., in August.

Nyanza Province.—Bukura Farmers' Training Centre provided 21 courses for 1,735 students and the Maseno Centre provided 29 courses for 615 students, comprising 308 farmers and 307 junior staff. Courses were also held for chiefs and sub-chiefs from South Nyanza district, which included a large amount of agricultural training.

A large percentage of the students at both Kisii and Kabianga were junior departmental staff undergoing training and refresher courses. At the Kisii Centre there were 44 courses for 1,547 students, divided into farmers—1,067, and junior staff—480. Many more would have attended at Kabianga but this Centre suffered from bad communications due to floods and heavy rain in the Kericho area in the latter part of the year. However, 990 students took part in 26 courses there. Of these, 788 were farmers and 202 junior staff. The impressive total of 4,887 students at the four Centres in Nyanza would have been much higher had the weather been normal.

Coast Province.—No Farmers' Training Centre exists at the Coast, but applications for finance have been made to various international bodies. The extension programme will be immeasurably strengthened when a Centre is eventually built. 200 acres of land have been obtained for this proposed Centre at Mtwapa. Bush schools mainly in the Kilifi and Taita districts are serving a very useful purpose and judging by attendance figures, are proving extremely popular.

Young Farmers' Clubs

A team of extension experts from U.S.A, financed by A.I.D. will include a Rural Youth Adviser, and he will advise on our rural youth organization. Encouragement and advice to existing Young Farmers' Clubs was given throughout the year.

The Department staged exhibits and entered for classes in many shows throughout the country. Field days, refresher courses and seminars held at various research stations and other departmental centres proved most successful.

Marketing

Details of exports from African areas in 1961 are given in Table D. The following is a review of the marketing in the provinces:—

Nyanza Province.—All districts reported that Nyanza Province Marketing Board had continued to market the annual crops efficiently. The amount paid to producers for all commodities including ghee and eggs was £1,033,053. The Board's total purchase of maize and other crops was 691,342 bags representing a fall of nearly 25 per cent compared with 1960. The Board was actively engaged in measures to meet food shortages, which occurred throughout Nyanza. Bulk storage of maize and other edibles amounted to the following:—

150,000 bags of maize;
80,000 bags of cassava;
1,800 bags of sorghum; and
500 bags of other commodities.

Seed requirements for replanting were sold at bare cost and 2,343 bags of various seed were disposed of in this way. Circulation of the Board's monthly bulletin rose to more than 2,200 copies per month.

Central Province.—The full benefits of increased production and higher quality standards can only be realized by farmers if their produce is efficiently marketed, and in this field the Central Province Marketing Board rendered a most valuable service.

Crops Purchased by the Central Province Marketing Board

	Bags
Maize	196,214
Paddy	149,039
Wheat	3,141
Canadian Wonder Beans	2,464
Rosecoco Beans	11,282
White Haricot Beans	36,672
Mixed Beans	24,013
Black Gram	20
Yellow Gram	8,017
Green Gram	6,224
Castor Seeds	2,412
Cow Peas	159
Pigeon Peas	51
	439,708

Tea production steadily increased and sales amounted to £62,397. Milk sales also increased, whilst purchase of miraa slightly decreased to £65,880.

Coffee, maize, fruit and vegetables, potatoes, pyrethrum, rice, pulses, wattle, charcoal, hides and skins were the first ten most important marketable items of the Province; yielding together £3,746,943 from a total income of £4,026,471. Coffee alone accounted for £2,208,927.

Rift Valley Province.—The general situation in regard to the establishment and operation of co-operative societies gives cause for concern. With the development of pyrethrum, coffee and sales of livestock products the number of co-operatives in the Province now presents a formidable task in terms of supervision.

The Provincial Agricultural Committee have been pressing for some time for the posting of a second co-operative officer based in Elgeyo/Marakwet.

Southern Province.—The Marketing Officer for the Province commenced his investigation of the problems affecting production in February of this year. The first result has been a considerable improvement in the inspection of produce exported from the district with the accompanying improvement of revenue for this service to the African District Council. With 11 inspectors the revenue collected totalled Sh. 23,834/54. Even so, the Marketing Officer reports that this is no true indication of the volume of trade as there are many routes by which traders may avoid paying their dues. Information is becoming available on the quantities of individual items of fresh produce sold for export from the district.

Coast Province.—The problem here is quite different from the other provinces due to traditional markets, the African's dislike of markets as known up-country and the old system whereby the grower is supplied with the necessities of life

by the local trader against his growing crops, and his consequent liability to dispose of his crops to the trader. There is also no proper wholesale market in Mombasa.

The whole subject is under study by the Provincial Agricultural Committee.

Grading and Inspection Services

Inspection.—The principal feature was the great increase, in quantity and value, of imports as compared with the previous year. This was a direct result of famine conditions over a wide area, which developed following firstly the failure of the long rains and secondly prolonged and serious flooding towards the end of the year and which necessitated the importation of large quantities of maize. The number of packages recorded rose from 469,163 in 1960 to 1,851,131 in 1961. This number includes imports of grain in bulk, each shipment of which is recorded as one parcel only. The value of imports rose from Sh. 34,020,869 in 1960 to Sh. 93,349,582 in 1961.

In all, 12 shipments of South African white maize amounting to 47,337 tons and five shipments of Rhodesian white maize amounting to 33,624 tons were received during the year. In addition, seven shipments of yellow maize amounting to 19,104 tons, were received from the United States of America, donated by the American Government for famine relief purposes.

There were six importations of Australian wheat, amounting to 6,817 tons and one shipment of 8,250 tons of Argentine wheat. A small proportion of the Argentine wheat was found to be damaged by water leakage in the vessel.

Imports of fresh fruit were slightly reduced as compared with the previous year. Australian apples fell by half and there were no imports of apples from the United Kingdom. Fresh fruit from Israel, particularly citrus, continued as a strong feature.

One consignment of 900 cases of Egyptian garlic, reshipped from Singapore, was found to be heavily contaminated with soil, and importation was prohibited. Garlic and onions received direct from Egypt were clean and in satisfactory condition.

Fumigation for the exclusion of *Trogoderma granarium* was ordered in 139 cases during the year. The commodities involved were principally foods and spices from India and Pakistan, Siam rice, grams, pulses, dates and oil seeds from Red Sea and Persian Gulf ports and grains and pulses from South and Central Africa. This pest does not occur in Kenya.

All maize from South Africa was fumigated on arrival. Maize from Rhodesia, which had been fumigated prior to shipment, was admitted without refumigation, but submitted to stringent precautions, including spraying of trucks, godowns and handling gear, in view of the possibility of reinfestation having occurred in transit through Portuguese East Africa.

Exports of castor seed continued to decline, amounting to 93,419 bags as compared with 122,914 bags in 1960. Kenya castor seed totalled 45,452 bags as against 58,758 bags in 1960.

A total of 335 Phytosanitary Certificates were issued during the year, as compared with 251 in 1960. 123 were for Uganda coffee, 15 for Tanganyika coffee and two for Kenya coffee. 102 were for Kenya potatoes consigned to Mauritius, where plant protection regulations were more strictly enforced than in previous years.

Grading.—There were no exports of Kenya maize and no grading was undertaken. Exports of ungraded maize, all of Tanganyika origin, comprised 6,668 bags.

The total quantity of beans submitted for grading during the year was 63,321 bags, as compared with 56,843 bags in 1960. White haricot comprised two-thirds of the total, amounting to 42,851 bags as against 9,001 in 1960. Figures for Canadian Wonder beans fell from 11,386 bags in 1960 to 2,537 bags in 1961, and those for mixed beans from 25,325 bags in 1960 to 16,239 bags in 1961. 2,453 bags Rosecoco beans were graded during the year. White haricot beans were mainly exported as Third and Fourth Grade, but mixed beans were placed in the Sixth Grade. Shipments of seed beans amounted to 37,991 bags, mostly of Tanganyika origin.

Exports of potatoes were well maintained and 84,456 cwt. were examined, of which 5,391 cwt. were rejected. Of those passed for shipment, 17,272 cwt. were graded as large and 60,613 cwt. as medium. 1,180 cwt. were exported as seed. The principal customers were Mauritius and Zanzibar. Main producing centres were Elburgon and Meru. All exports were of Kenya origin.

The volume of exports of small chillies again increased as compared with the previous year, from 5,383 bags to 9,125 bags. Quality was poor and 9,076 bags, all of Uganda origin, were passed as undergrade. The decline in exports of capsicums in recent years was even more pronounced in 1961, the total falling from 7,223 bags in 1960 to 2,252 bags. Quality was generally satisfactory and 1,814 bags were passed as F.A.Q.

Inspection of Horticultural Produce.—439 Horticultural Produce Export Certificates were issues, covering a total of 1,077,028 lb. fruit and vegetables, value at Sh. 345,118 (this figure excludes the value of produce exported prior to 9th February, 1961, on which date recording of values began).

Revenue.—Revenue from grading and inspection fees fell considerably, amounting to Sh. 20,347/45 as compared with Sh. 32,984/50 in 1960.

SUMMARY—PRODUCE GRADED 1961

	Beans			Potatoes	
	Bags	*Tons*		*Cwts.*	*Tons*
K.3	22,662	2,023	KL.. ..	17,272	864
K.4	24,324	2,172	KM ..	60,613	3,031
K.6	16,783	1,498	KS.. ..	1,180	59
RJ	552	49	RJ	5,391	269
	64,321	5,742		84,456	4,223

	Chillies		Capsicums	
	Bags	*Tons*	*Bags*	*Tons*
GAQ ..	—	—	—	—
FAQ ..	49	1	1,814	36
UG	9,076	324	438	9
RJ	101	4	—	—
	9,226	329	2,252	45

Quelea Control and Research

General.—Climatic extremes experienced during the year produced a multitude of phenomena in the behaviour and breeding habits of *Quelea quelea* in East Africa. The failure of the 1960 short rains and 1961 long rains resulted in unprecedented drought conditions, aggravated by severe overgrazing, over the greater part of the species' range. This curtailed the long rains breeding to relatavely small areas where some sustenance for rearing young was to be found, but which would have been ignored as unsuitable for breeding requirements in normal seasons. After these attempts, both breeding and non-breeding birds were observed to move northwards, but the annual migrations were haphazard; concentrations preferring to remain within reach of permanent swamps and other water only moving from area to area when forced to do in search of "shed" grass seeds.

Heavy widespread rain during the last three months of the year reversed the situation, when ideal conditions prevailed everywhere. Concentrations have been difficult to locate in the virtually impassable countryside and when found are fickle, only remaining in one spot long enough to construct partial nests before moving on.

Control.—At the breeding colonies found in the Kondoa-Irangi area an almost 100 per cent destruction of young and adults was achieved by the "curtain" method of aerial spraying. Large roosts near Dodoma, Kondoa, Babati and the Southern Uaso-Nyiro (Kenya) was also successfully sprayed. Some 660 acres were covered in all, 47 million young and adults estimated from random counts, being destroyed. It was necessary to carry out a number of small aerial sprays and "blow-ups" as small concentrations arrived in the Oldeani and West Kilamanjaro districts in Tanganyika and a few small "blow-ups" in various areas in the Kenya wheatlands. Damage to crops was kept to a minimum.

Research.—As the present technique of aerial spraying, using a 50 per cent parathion emulsion diluted with an equal quantity of diesel fuel, is considered both economical and efficient, further research into the possible use of other more toxic, but less residual chemicals has been discontinued.

Routine observations of the biological behaviour of *Quelea quelea* has been maintained and further returns of numbered rings have again confirmed previous migratory theories.

Close contact has been kept with specialist working on this problem in other parts of Africa. Mr. Lourens of the Division of Entomology, South Africa, and Mr. Dare, Ornithologist to the Republic of the Sudan, visited Kenya during the year to study at first hand the problem in East Africa and the methods utilized to overcome it.

Forecast.—Although the *Quelea* problem is well in hand there may be an upward population swing within the next few months due to short rain breeding in inaccessible regions. It will largely depend on the severity of the next rains, whether the temporary increase can be contained, but in any case it is anticipated that any infestation can be dealt with.

Coypu.—A preliminary investigation into the possible menace of coypu rats which escaped from captivity some 20 years ago in the Nanyuki districts, was carried out. The present danger to crops and dams is not considered serious, but a careful watch should be kept in case of a rapid population development.

PART IV.—GENERAL

Library

The Rockefeller grant mentioned last year extended to cover 1961 and it was possible to continue the good work of building up the libraries at research stations and at farm institutes and field stations. In all almost one thousand volumes were added to various libraries. The following journals were added to those already taken by the Department: *Australian Journel of Experimental Agriculture and Animal Husbandry, Crop Science, The International Sugar Journal, Journal of the National Institute of Agricultural Botany, Weed Abstracts.* Four issues of the Newsletter appeared during the year.

Publications

The following is a list of articles by departmental officers published during the year:—

Bellis, E.—A guide to fertilizer use in Kenya. *Kenya Farmer,* Nos. 65 and 66. (November and December.) (Subsequently published as a booklet.)

Bellis, E.—Serving the Kenya Dairy farmer. *Kenya Dairy Farmer 9* (4), 14.

Betts, R. D. W.—Skim milk in bacon pig rations. *Kenya Farmer,* No. 63 (September). p. 22.

Bogdan, A. V.—Breeding behaviour of *Cenchrus ciliaris* in Kenya. *E. Afr. agric. for. J. 26,* 241.

———— The depth of planting Rhodes grass seed. ibid. *26,* 187.

———— Inter-variety variation in Rhodes grass (*Chloris gayana* Kunth) in Kenya. *J. Brit. Grassl. Soc. 16* (3), 238.

Bogdan, A. V. and Pratt, D. J.—Common acacias of Kenya. Nairobi, Govt. Printer.

Boswinkle, E.—Residual effects of phosphorus fertilizers in Kenya. *Emp. J. exp. Agric. 29,* 136.

Brown, L. H.—Revolution in land use. East African Annual, 1961—2. Nairobi, *East African Standard.*

Bullock, J. A.*—Control of the dusty brown beetle and false wireworm. *Kenya Farmer,* No. 55, p. 9 (January).

———— Control of the shiny cereal weevil and legless grub (*Nematocerus*) ibid.

———— *Nematocerus* sp. (nr. *brevicornis* Hust.): A pest of cereals in Kenya. I—The bionomics and control of the adult and larva. *E. Afr. agric. for. J. 27,* 24. II—The effect of insecticides on the ova. ibid., p. 117. III—Laboratory tests with insecticides against the newly hatched larvae. ibid., p. 121.

———— The pests of pyrethrum in Kenya. *Pyrethrum Post 6* (2), 22.

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* Now Lecturer in Entomology, University of Malaya, Kuala Lumpur.

Clarke, R. T.—The efficiency of blocks in some experiments in Kenya. *E. Afr. agric. for. J. 26,* 230.

———— A manurial trial on sugar. *E. Afr. agric. for. J. 26,* 184.

Crowe, T. J.—The use of insecticides on coffee in East Africa. *Agric. vet. Chem. 2,* 77.

Crowe, T. J., Glynne Jones, G.D. and Williamson, R.—The use of pyrethrum formulations to control *Antestiopsis* on coffee in East Africa. *Bull ent. Res. 52,* 31.

Dixon, G. E.—Loose smut in certain wheats. *Kenya Weekly News* (K.F.A. Bulletin), 3-11-61, p. 55 and 17-11-61, p. 55.

———— New wheat for short rains. *Kenya Weekly News* (K.F.A. Bulletin), 21-7-61, p. 55 and 11-8-61, p. 53.

———— Pedigree cereal seed production, 1962. *Kenya Weekly News* (K.F.A. Bulletin), 22-12-61, p. 53 and 29-12-61, p. 37.

———— Releases and choices of cereals for 1961. *Kenya Weekly News,* 17-2-61, p. 47.

Dixon, G. E. and Ensor, D. H. P.—Seed wheat field approval scheme, 1961. *Kenya Information Services Bulletin,* No. 21 (June) and *Kenya Weekly News* (K.F.A. Bulletin), 16-6-61, p. 53.

Dougall, H. W.—Average nutritive value of Kenya feeding stuffs for pigs. *E. Afr. agric. for. J. 26,* 220.

———— Estimation of the average total digestible nutrients in pig feeds. *J. agric. Sci. 56,* 117.

———— Milk production from pastures. *J. agric. Sci. 56,* 261.

———— Tables of estimates of nutritive values of pig feeds. *E. Afr. agric. for. J. 26,* 220.

———— Urea in the diet of the ruminant. *Kenya Farmer,* No. 62, p. 19 (August).

Gough, C. L.—Ventilated bins. *Kenya Coffee 26,* 131.

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Legislation

The greater part of the legislation affecting agriculture enacted during the year was of a routine nature, the only matters of outstanding importance being further legislation regarding the Special Crops Development Authority set up in 1960, the Ordinance providing for a specific loan of £3,350,000 from the International Bank for Reconstruction and Development and the Colonial Development Corporation (No. 6 of 1961), to finance the development of farms in the Scheduled (European) Areas and the settlement of farmers of all races particularly Africans, on such farms, and the Cotton Rules, 1961.

The Order (L.N. 458 of 1960) setting up the Special Crops Development Authority was cancelled and replaced by a new Order (L.N. 243 of 1961) in which the constitution of the Authority was defined in more detail. Thereafter the Authority issued Orders imposing a levy on all green tea leaf sold to the Authority on a graded poundage for each 1,000 tea stumps planted and also laid down the price to be paid to the grower. Cultivation orders were also issued. At the same time new Cultivation Regulations (L.N. 752 of 1961) applying to all tea-growing areas in the Colony were issued under the Tea Ordinance and the Native Lands Tea Rules, 1953, were revoked.

Kenya Cotton Rules, 1961, replaced Rules originally promulgated in 1937, and are a great advance on the old version. The principal points of revision are: —

(i) a tighter control over cotton buying, particularly as regards the categories to whom buying licences can be issued (Rules 9 to 15);

(ii) a new control over the apparatus used for weighing cotton at buying centres proposed by the Weights and Measures Department following their investigations into alleged malpractices in Nyanza (Rule 24);

(iii) an extension of the powers of inspection and control to all the officers concerned including the Cotton Board's staff, and Weights and Measures inspectors (the old rules were particularly defective in this respect);

(iv) a more comprehensive control over ginning procedures to ensure higher and more uniform standards of cleanliness and purity (Rules 37-40 and 46-50).

The main intention is to provide for a tighter control of all the operations from the point of growing through to the disposal of ginned cotton which should be particularly beneficial to the grower, in preventing malpractices at buying centres, and to improve the standard of cotton offered by Kenya on the world market.

Other legislation of some importance enacted during the year was as follows: *Dairy Industry Ordinance.*—Regulations covering the licensing of retailers; inspectors; cess on retailed milk; sales by producers.

Staff

Mr. E. C. M. Green was promoted to Assistant Director of Agriculture, and Mr. G. E. Dixon was promoted to Senior Research Officer.

There were ten resignations of officers on the A scale, and the following officers were appointed to that scale during 1961: Messrs. W. A. Wright (on transfer from Mauritius), R. B. Contant, P. J. Sauvage, E. C. Bush, T. J. Kennedy, and J. W. Maina. In addition, six promotions to the A scale took place within the Department. They are Messrs. W. O. Omamo, P. Vuviya, J. S. Mburu, J. M. Kiambati, J. J. Njoroge and F. F. Pinto who were promoted to be Agricultural Officers. Thirty-six Assistant Agricultural Officers were appointed during the year, 12 of which were in-service promotions, and 30 resignations took place in the Assistant Agricultural Officer grade. There were ten promotions to Specialist Tea Officers and one new appointment to that grade. In addition there was one promotion to Senior Assistant Agricultural Officer. At the end of the year there were no vacancies on the A scale, and ten vacancies on the C scale.

The Officer Grade.—The Department of Agriculture had six African Agricultural Officers out of a total of 110 and 50 African Assistant Agricultural Officers out of a total of 250 at the end of the year.

All staff in the Department have had to work under difficult and, at times, very frustrating conditions. Under all the difficulties we had to face in 1961 the staff has risen to the occasion magnificently, and we share with Kenya's farmers of all races a proud record of achievement in terms of agricultural production and progress. The odds against us have been heavy but they have been faced with great courage by the entire agricultural industry.

I am very glad to have this opportunity to thank my staff for the splendid efforts they have made in all branches of the Department in 1961.

A. R. MELVILLE,
Director of Agriculture.

21st March, 1962.

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